TRANS MOUNTAIN EXPANSION PROJECT

APPLICATION FOR AMENDMENT OF ENVIRONMENTAL ASSESSMENT CERTIFICATE NO. E17-01
COLDWATER WEST ALTERNATIVE REROUTE
COLDWATER, BC

October 2020

01-13283-S5A-M002-EV-RPT-0018

Prepared for:

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

TABLES OF CONCORDANCE

Table 0-1 indicates where updates to information is provided in sections of the Environmental Assessment Certificate (EAC) Application (*i.e.*, Supplemental Filling submitted in August 2016) as a result of the proposed amendment (or the West Alternative Reroute).

Table 0-1 also indicates where information in the EAC Application and this Amendment Application is provided in the Canada Energy Regulator (CER) Application for the proposed West Alternative Reroute (Filing ID C08844) or in the original Environmental and Socio-Economic Assessment (ESA) filed with the National Energy Board (now the CER) in December 2013 for the certified Trans Mountain Expansion Project (TMEP or the Project).

TABLE 0-1

TABLE OF CONCORDANCE WITH THE ENVIRONMENTAL ASSESSMENT CERTIFICATE APPLICATION FOR THE TRANS MOUNTAIN EXPANSION PROJECT

Sections in the EAC Application (2016 Supplemental Filing)	Update Required in Amendment Application (Yes/No)	Location in CER s. 190 Application
1.0 TRANS MOUNTAIN EXPANSION PROJECT SUPPLEMENTAL FILING TO THE BRITISH COLUMBIA ENVIRONMENTAL ASSESSMENT OFFICE		
1.1 Purpose	Yes – see Section 1.0, Introduction	Section 1.0 in Part 2 of 3 of the CER s. 190 Application
1.2 Structure of Supplemental Filing	Yes – see Table of Contents of this Amendment Application	--
1.3 Contact Information	Yes – Section 1.1, Contact Information	--
2.0 PROJECT DESCRIPTION		
2.1 Project Scope	Yes – see Section 1.0, Introduction	Section 1.0 in Part 2 of 3 of the CER s. 190 Application
2.1.1 Pipelines	Yes – see Section 1.0, Introduction	Sections 1.0 and 1.2 in Part 2 of 3 of the CER s. 190 Application
2.1.2 Pump Stations	No – there is no change to proposed pump stations associated with the Approved Route, as described in the EAC Application	-- (described in the original ESA [Section 2.2 of Volume 2, Filing ID A55987])
2.1.3 Tank Terminals	No – there is no change to proposed tank terminals associated with the Approved Route, as described in the EAC Application	-- (described in the original ESA [Section 2.3 of Volume 2, Filing ID A55987])
2.1.4 Westridge Marine Terminal	No – there is no change to Westridge Marine Terminal associated with the Approved Route, as described in the EAC Application	-- (described in the original ESA [Section 2.3.2 of Volume 2, Filing ID A55987])
2.1.5 Marine Transportation	No – there is no change to proposed marine transportation associated with the Approved Route, as described in the EAC Application	-- (described in the original ESA [Section 2.6 of Volume 2, Filing ID A55987])
2.2 Project Execution	Yes – see changes to Project schedule and Project activities (see Sections 2.3 and 2.1, respectively)	As stated in the cover letter for the CER s. 190 Application (Filing ID C08844), the anticipated in-service date is currently no later than December 31, 2022. In order to meet this timing, construction-related activity on the West Alternative, including mobilization, should commence by August 2021. Updated Project Schedules are provided to the CER monthly under Condition 62.
2.2.1 Project Schedule	Yes – see Section 2.3, Schedule	See above regarding 2.2 Project Execution
2.2.2 Project Activities	Yes – see Section 2.1 Description of the Coldwater West Alternative Reroute	Section IV in Part 1 of 3 of the CER s. 190 Application (Filing ID C08844)
2.2.3 Pipeline Operation and Maintenance	No – there is no change to project execution, as described in the EAC Application	-- (described in the original ESA [Sections 2 to 11 of Volume 4C, Filing ID A56004])
2.2.4 Abandonment	No – there is no change to project execution, as described in the EAC Application	-- (described in the original ESA, [Section 12 of Volume 4C, Filing ID A56004])

TABLE 0-1 Cont'd

Sections in the EAC Application (2016 Supplemental Filing)	Update Required in Amendment Application (Yes/No)	Location in CER s. 190 Application
3.0 PROJECT LOCATION AND MAPS		
3.1 Regional Maps	Yes – see Section 2.1 and Appendix A	Section 1.2 and Figure 1 in Part 2 of 3 of the CER s. 190 Application
3.2 Description and Location of Lands	Yes – see Section 2.1 and Appendix A	Section 1.2 and Figure 1 in Part 2 of 3 of the CER s. 190 Application
4.0 STAKEHOLDER ENGAGEMENT OVERVIEW		
4.1 Stakeholder Communities and Groups	Yes – see Section 4.0	Sections 2.0 and 2.1 in Part 2 of 3 of the CER s. 190 Application
4.2 Stakeholder Engagement Updates	Yes – see Section 4.0	Sections 2.0 and 2.1 in Part 2 of 3 of the CER s. 190 Application
4.3 Future Stakeholder Engagement Activities	No – there is no change to the proposed future engagement activities, as described in the EAC Application	-- (described in the original ESA, [Volume 3A, Filing ID A55987])
5.0 ABORIGINAL ENGAGEMENT OVERVIEW		
5.1 Aboriginal Groups	Yes – The list of Indigenous groups engaged on the West Alternative was slightly revised to reflect the geographic location. The list of groups engaged in provided in the CER Variance Application (Table 1)	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
5.1.1 Identification of Aboriginal Groups	See above regarding 5.1 Aboriginal Groups	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
5.1.2 Geographic Location of Aboriginal Groups	See above regarding 5.1 Aboriginal Groups	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
5.1.3 Aboriginal Groups Engaged	See above regarding 5.1 Aboriginal Groups	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
5.2 Methods of Engaging Aboriginal Groups	No – there is no change to methods of engaging Aboriginal groups (now Indigenous groups), as described in the EAC Application	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
5.2.1 Comprehensive Aboriginal Engagement Process	No – see above regarding 5.2 Methods of Engaging Aboriginal Groups	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
5.3 Aboriginal Engagement Updates	Yes – see Section 5.0	Sections 2.0 and 2.2
5.4 Future Aboriginal Engagement Activities	No – there is no change to the proposed future engagement activities, as described in the EAC Application	-- (described in the original ESA, [Volume 3B, Filing ID A55987])
6.0 LANDOWNER ENGAGEMENT OVERVIEW	No – there is no change to an overview of landowner engagement, as described in the EAC Application	-- (described in the original ESA, [Volume 3C, Filing ID A55987])
7.0 REGULATORY CONTEXT		
7.1 Federal Regulatory Context	Yes – see Section 1.0, Introduction	Section 1.1 in Part 2 of 3 of the CER s. 190 Application
7.1.1 National Energy Board Review	Yes – see Section 1.0, Introduction	Section 1.1 in Part 2 of 3 of the CER s. 190 Application
7.1.2 Federal Permits	Yes – see Section 1.0, Introduction; and Appendix B	Section 3.2 in Part 2 of 3 of the CER s. 190 Application
7.2 Provincial Regulatory Context	Yes – see Section 3.4, Regulatory Context, and Appendix B	--
8.0 ISSUES SUMMARY		
8.1 Overview	Yes – see Section 2.2, Justification of Proposed Amendment	Section 4.0 in Part 2 of 3 of the CER s. 190 Application
8.2 Province of British Columbia	No – no new issues have been raised to date; further engagement with the Province of British Columbia will be conducted through the permitting process	--
8.2.1 Pipeline Valve Locations to Limit Maximum Spill Volumes	See above	--

TABLE 0-1 Cont'd

Sections in the EAC Application (2016 Supplemental Filing)	Update Required in Amendment Application (Yes/No)	Location in CER s. 190 Application
8.2.2 Pipeline Spill Prevention through Pipeline Design	See above	--
8.2.3 Pipeline Leak Detection	See above	--
8.2.4 Challenges in Responding to a Pipeline Spill and Pipeline Spill Preparedness and Spill Response Planning	See above	--
8.2.5 Spills Affecting Drinking Water	See above	--
8.2.6 Visual Effects of the Pipeline Right-of-Way	See above	--
8.2.7 Marine Spill Preparedness and Response	See above	--
8.3 Municipalities and Regional Districts	No – there is no change to issues raised by Municipalities and Regional Districts, as described in the EAC Application	Section VII.C – Stakeholder Engagement, in Part 1 of 3 of the CER s. 190 Application (Filing ID C08844)
8.4 Summary of Issues Resolution	No – there is no change to issues resolution, as described in the EAC Application	--

Table 0-2 summarizes the Section 25 required assessment matters included in the 2018 British Columbia (BC) *Environmental Assessment Act* (BC *EAA*) and where they are addressed in this Amendment Application and/or in the CER s. 190 Application for the West Alternative Reroute (Filing ID C08844).

TABLE 0-2

CONCORDANCE WITH SECTION 25 OF THE BRITISH COLUMBIA *ENVIRONMENTAL ASSESSMENT ACT*

British Columbia Environmental Assessment Office Required Assessment Matters	Included in Amendment Application (Location in Document)	Location in CER s. 190 Application	Rationale
1 The effects of the Project on Indigenous nations and rights recognized and affirmed by Section 35 of the *Constitution Act*, 1982 must be assessed in every assessment	Yes (Section 5.0)	Sections 2.2, 3.0, 3.1, and 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	No new or additional potential interactions or effects specific to Indigenous rights are anticipated to occur as a result of the West Alternative Reroute (the proposed amendment or the West Alternative). Since May of this year, Trans Mountain President and CEO, Ian Anderson, has been meeting regularly with Chief Lee Spahan of Coldwater Indian Band, attempting to reach consensus on routing. In early October, Coldwater Indian Band confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community, subject to further engagement with the Coldwater Indian Band Community, Chief Spahan and Council have confirmed their support for the proposed West Alternative and the CER Variance Application. In addition to its engagement with Coldwater Indian Band, Trans Mountain has engaged with other potentially affected Indigenous groups regarding the West Alternative and has been working with those groups to address any comments or concerns raised. Most groups have deferred to Coldwater Indian Band's position on the West Alternative and no groups have communicated opposition to the West Alternative. The current Project-specific EAC Conditions of the Certificate E17-01 (*e.g.*, Conditions 10, 12, 13, 16, 17, 22, 23, 25, and 27) and CER Conditions of the Certificate OC-065 (*e.g.,* Conditions 13, 40, 43, 44, 45, 47, 48, 59, 71, 72, 93, 94, 96, 97, 98, 100, 145, and 146) that are potentially applicable to the proposed amendment are anticipated to reduce or alleviate potential effects on Indigenous rights.

TABLE 0-2 Cont'd

British Columbia Environmental Assessment Office Required Assessment Matters	Included in Amendment Application (Location in Document)	Location in CER s. 190 Application	Rationale
2(a) Positive and negative direct and indirect effects of the reviewable project, including environmental, economic, social, cultural and health effects and adverse cumulative effects	Yes (Sections 3.5 to 3.7)	Section 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	Section 3.2 of the CER s. 190 Application (Filing ID C08844) for the proposed amendment and Sections 3.5 to 3.7 of this Amendment Application include effects assessment conclusions for biophysical and socio-economic elements. To avoid repetition, effects of the Project are not repeated in this Amendment Application and cross references to the CER s. 190 Application for the West Alternative (Filing ID C08844) and the original ESA and related filings are provided instead. Negative direct and indirect effects were discussed and assessed in Section 3.2 of the CER s. 190 Application (Filing ID C08844) and in Sections 3.5 to 3.7 of this Amendment Application, and in the original ESA and related filings identified as follows: Volumes 5A and 5B of the original ESA (Filing ID A56004) ESA Update (Filing ID A4F4Z3) Responses to Information Request No. 2.031, 2.041, 2.053, and 2.068 (Filing ID A3Z4T9) Responses to Information Request No. 3.025 (Filing ID A4H1V2) Positive direct and indirect effects were discussed and assessed in Section 3.2 of the CER s. 190 Application for the West Alternative (Filing ID C08844), in Section 3.7 of this Amendment Application, and in the original ESA and related filings identified as follows: Volume 5B of the original ESA (Filing ID A56004) Responses to Information Request No. 2.041 and 2.042 (Filing ID A3Z4T9) Responses to Information Request No. 3.036 (Filing ID A4H1V2) No new or additional potential interactions or positive and negative direct and indirect effects are anticipated to occur as a result of the West Alternative.
2(b) Risks and uncertainties associated with those effects, including the results of any interaction between effects	No	Not assessed (see Rationale)	In the assessment of potential adverse effects of the Project, including the proposed amendment, there are no situations where there is a high degree of uncertainty with the possibility of a significant adverse effect. Furthermore, the post-construction monitoring programs and the associated EAC Condition and CER Condition Plans are considered sufficient to manage the potential risk. Therefore, the assessments do not contain additional information on risk. As described in Section 7.1 (Methodology) of the original ESA and included as Appendix F of the CER s. 190 Application (Filing ID C08844) for the proposed amendment, the probability of occurrence was included in the characterization of residual effects.
2(c) Risks of malfunctions and accidents	No	Section 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	The proposed amendment is not expected to have any new risks of malfunctions or accidents that have not been identified and assessed in the original ESA.
2(d) Disproportionate effects on distinct human populations identified by gender	Section 3.5	Section 3.0 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	This is a new required assessment matter not previously included under the 2015 version of the BC *EAA*. The assessment team considered any changes from the West Alternative relevant to this assessment matter relative to the Approved Route. The Socio-Economic Technical Report (Volume 5D [Filing ID A56011]) of the original ESA provided various background and demographic information that contributes to understanding distinct human populations that may be affected by the Project, including Indigenous women and children. The information included in the Socio-Economic Technical Report of the original ESA outlined the local and regional economic context, biological gender identification (e.g., male/female), Indigenous identification, age group, income, labour force participation, and educational attainment. Information on local and regional labour force activity, educational attainment, as well as income and earnings for the Regional Districts, Municipalities, and Indigenous communities considered in the original ESA do not materially change for the proposed amendment. Interactions and potential effects on social and cultural well-being, human occupancy and resource use [HORU], infrastructure and services, employment and economy, and community health were assessed in the original ESA (Section 7.0 of Volume 5B [Filing ID A3S1S9]) and related filings.

TABLE 0-2 Cont'd

British Columbia Environmental Assessment Office Required Assessment Matters	Included in Amendment Application (Location in Document)	Location in CER s. 190 Application	Rationale
			No new or additional potential interactions or effects specific to distinct human populations are anticipated to occur as a result of the proposed amendment. The current Project-specific EAC Condition 23 (Worker Accommodation Strategy of the Certificate E17-01) and CER Conditions (*e.g.,* CER Condition 13: Socio-economic Effect Monitoring Plan, and CER Condition 59: Worker Accommodation Strategy) of the Certificate OC-065 have been reviewed and approved by the respective agencies. These are potentially applicable to the proposed amendment and are anticipated to reduce or alleviate potential effects on distinct human populations.
2(e) Effects on biophysical factors that support ecosystem function	Section 3.6	Section 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	This is a new required assessment matter not previously included under the 2015 version of the BC *EAA*. The assessment team considered any changes from the West Alternative relevant to this assessment matter relative to the Approved Route. Baseline conditions of the proposed amendment as related to biophysical factors (*e.g.,* vegetation, fisheries, wetlands, wildlife and wildlife habitat and soils) that support ecosystem function are provided in the biophysical technical reports of the CER s. 190 Application (Filing ID C08844) (Appendices A to E of the CER s. 190 Application). Potential effects on biophysical factors (*e.g.*, vegetation, fisheries, wetlands, wildlife and wildlife habitat and soils) that support ecosystem function were assessed for various spatial boundaries, including ecosystem-, landscape- or watershed-scale analysis where feasible, in the original ESA (Volume 5A [Filing ID A56004]), in Responses to Information Request No. 3.025 (Filing ID A4H1V2), and in Section 3.2 of the CER s. 190 Application for the West Alternative (Filing ID C08844). No new or additional potential interactions or effects on biophysical factors that support ecosystem function are anticipated to occur as a result of the proposed amendment. The mitigation and monitoring commitments outlined in Section 3.2 of the CER s. 190 Application (Filing ID C08844) are anticipated to reduce or alleviate potential effects on biophysical factors that support ecosystem function. Based on the evaluation presented in Section 3.6 of this Amendment Application and the assessment of predicted residual effects and the significance conclusions of residual and cumulative effects on those biophysical factors as described in Section 3.2 of the CER s. 190 Application for the West Alternative (Filing ID C08844), it is predicted that ecosystem-, landscape-, or watershed-level effects of the proposed amendment on biophysical factors that support ecosystem function are not significant.
2(f) Effects on current and future generations	Section 3.7	Section 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	This is a new required assessment matter not previously included under the 2015 version of the BC *EAA.* The assessment team considered any changes from the West Alternative relevant to this assessment matter relative to the Approved Route. For biophysical and socio-economic elements (*e.g.*, greenhouse gas [GHG] emissions, soil and soil productivity, fish and fish habitat, wetland function, vegetation, wildlife and wildlife habitat, Traditional Land and Resource Use [TLRU], HORU, social and cultural well-being, and community health) that potentially have long-term or permanent residual effects on current and future generations as well as Indigenous interests, including Section 35 rights, the conditions applicable to the Project are comparable to the existing conditions and mitigation measures assessed in the original ESA (Section 7.0 of Volume 5B [Filing ID A3S1S9]) and related filings; no new or unique interactions between the West Alternative and those biophysical and socio-economic elements have been identified. Coldwater Indian Bandhas confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community. The proposed amendment does not result in any material change to the assessment of potential adverse effects, mitigation, or residual effects for GHG emissions, soil and soil productivity, fish and fish habitat, wetland function, vegetation, wildlife and wildlife habitat, TLRU, HORU, social and cultural well-being, and community health elements during any phase of the Project. As a result, there are no anticipated significant effects to community or Indigenous future generations.

TABLE 0-2 Cont'd

British Columbia Environmental Assessment Office Required Assessment Matters	Included in Amendment Application (Location in Document)	Location in CER s. 190 Application	Rationale
			The Project, including the proposed amendment will provide positive benefits by means of employment, government revenues, and economic development and diversification for the Regional and Local communities. The benefits of the Project to future generations will be sustained for the life of the Project and into the future and that these economic benefits were assessed in the original ESA (Section 7.0 of Volume 5B [Filing ID A3S1S9]).
2(g) Consistency with any land-use plan of the government or an Indigenous nation if the plan is relevant to the assessment and to any assessment conducted under Section 35 or 73.	Yes (Sections 3.0 and 5.0)	Sections 2.0 and 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	Interactions and potential effects on land use were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and in the EAC Application. No new or unique interactions between the West Alternative and land use plan of the government or an Indigenous group have been identified. Further, Coldwater Indian Band has confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community.
2(h) Greenhouse gas emissions, including the potential effects on the Province being able to meet its targets under the *Greenhouse Gas Reduction Targets Act.*	No	Section 3.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	An assessment of Project-related GHG emissions was previously required under the *National Energy Board Act*. Interactions and potential effects of GHG emissions were assessed in the original ESA and related filings. No new or unique interactions between the West Alternative and GHG emissions have been identified. An assessment of the potential effects on the Province's ability to meet its targets under the *GHG Reduction Targets Act* is a new requirement since the EAC Application and the assessment team considered any changes associated with the West Alternative relevant to this assessment matter relative to the Approved Route. The proposed amendment is not expected to materially increase GHG emissions relative to the Approved Route and, therefore, the West Alternative will not notably contribute to or hinder the Province's efforts to reduce GHG emissions. The current Project-specific EAC Condition 29 (Greenhouse Gas Offsets) of the Certificate E17-01 and CER Condition 142 (GHG Emissions Offset Plan) of the Certificate OC-065 are anticipated to reduce potential effects of GHG emissions and to include a plan for contributing to the Province's efforts to meet its targets under the *Greenhouse Gas Reduction Targets Act*.
2(i) Alternate means of carrying out the project that are technically and economically feasible, including through the use of best available technologies, and the potential effects, risks and uncertainties of those alternatives	Yes (Section 2.0)	Section 1.2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	Coldwater Indian Band has confirmed that the West Alternative addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community and that, subject to further community engagement, it is supportive of the West Alternative and the CER Variance Application.
2(j) Potential changes to the reviewable project that could be caused by the environment	No	Section 3.2, Table 2 in Part 2 of 3 of the CER s. 190 Application (Filing C08844)	There are no new potential effects from the environment on the TMEP expected as a result of the proposed amendment that have not been identified and assessed in the original ESA and related filings.
2(k) Other prescribed matters	No	No	There were no other prescribed matters in the EAC Application, original ESA and related filings.

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
AK	Alternative Kilometre Post
BC	British Columbia
BC *EAA*	British Columbia *Environmental Assessment Act*
BC EAO	British Columbia Environmental Assessment Office
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
Coldwater IR	Coldwater Indian Reserve No. 1
DPI	Direct Pipe® Installation
EA	Environmental Assessment
EAC	Environmental Assessment Certificate
ECCC	Environment and Climate Change Canada
EPP	Environmental Protection Plan
ESA	Environmental and Socio-economic Assessment
FOTS	fibre-optic transmission system
GHG	greenhouse gas
HDD	horizontal directional drill
HORU	Human Occupancy and Resource Use
km	kilometre(s)
KP	Kilometre Post
m	metre(s)
NEB	National Energy Board
the Application	Facilities Application under Section 52 of the *National Energy Board Act*
the Approved Corridor	corridor previously approved by Canada Energy Regulator - Project corridor that passed to the east of Coldwater Indian Reserve No. 1
the Project or TMEP	Trans Mountain Expansion Project
the West Alternative, Reroute or Coldwater West Alternative Reroute	approximately 18.4 km Reroute of the Project to the west of the Approved Route to avoid the Coldwater Indian Reserve No. 1
TLRU	Traditional Land and Resource Use
TMPL	Trans Mountain Pipeline system (existing)
Trans Mountain	Trans Mountain Pipeline ULC
WHA	Wildlife Habitat Area

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) is applying for an amendment to Environmental Assessment Certificate (EAC) E17-01 issued on January 10, 2017. The EAC was granted, subject to 37 Conditions, with respect to the construction and operation of the Trans Mountain Expansion Project (TMEP or the Project). The Project involves the twinning of the existing 1,147 km Trans Mountain pipeline (TMPL) from Edmonton, Alberta to Burnaby, British Columbia (BC). The components of the Project in BC are described in Schedule A Certified Project Description and the associated Certified Project Corridor Mapbook.

On October 9, 2020, Trans Mountain applied to the Canada Energy Regulator (CER) under s.190 of the *Canadian Energy Regulator Act* (*CER Act*) to vary the Approved Corridor. The CER s. 190 Application (Filing ID C08844) is currently being reviewed by the CER.

Under the Environmental Assessment (EA) Equivalency Agreement (National Energy Board [NEB] BC Environmental Assessment Office [BC EAO] Agreement) entered into in 2010 it is stated that BC will accept the CER's EA of a project that would otherwise have been reviewed under BC's *Environmental Assessment Act* (BC *EAA)*. In January 2016, the BC Supreme Court ruled that projects subject to this agreement still required a decision regarding the issuance of a Provincial EAC under the BC *EAA*. Subsequent to that decision, Trans Mountain filed a supplemental Application to the EA in 2016 and, on January 10, 2017, the BC EAO issued EAC E17-01 for the TMEP.

This Amendment Application seeks approval of a revised corridor in the Coldwater Valley., hereinafter called, the Coldwater West Alternative Reroute ("West Alternative" or "Reroute"). As further discussed herein, Trans Mountain is seeking removal of Condition 25 from the EAC.

1.1 Contact Information

All communication with Trans Mountain concerning this Amendment Application should be directed to:

Katie McKinnon
Senior Regulatory Advisor
Trans Mountain Expansion Project
Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue SW
Calgary, Alberta T2P 5J2
Phone: 403-514-6400
regulatory@transmountain.com

Information on the proposed amendment is also available at www.transmountain.com

2.0 PROPOSED PROJECT CHANGES

2.1 Description of the Coldwater West Alternative Reroute

The corridor and pipeline route for the West Alternative are shown in the Certified Project Corridor Mapbook in Appendix A. The West Alternative deviates from the Approved Corridor at KP 931.43 and joins the Approved Corridor at KP 946.88. The West Alternative is located on Crown land for 14.45 km and privately owned land for 3.91 km in Thompson-Nicola Regional District, BC, near Merritt, BC, for a total length of 18.36 km.

Approximately 14.3 km of the West Alternative is parallel to other linear features (*e.g.,* Enbridge [Spectra] right-of-way, TELUS fibre-optic transmission system [FOTS]) (Jacobs 2020b; Kinder Morgan 2012) and the remaining 4 km of the West Alternative is greenfield (*i.e*., not adjacent or parallel to any existing utility or road feature).

Trans Mountain will utilize existing access roads and trails to the extent possible to support construction and operation of the TMEP along the West Alternative. Some roads may require upgrading prior to construction to ensure roads are safe for crew and equipment travel but will be decommissioned after construction with the exception of permanent access roads that will be required for ongoing access to the valve sites.

This section of the Approved Route is 15.45 km long, and the West Alternative measures 18.36 km, an additional 2.91 km. As the West Alternative deviates west from the Approved Corridor, it crosses the Coldwater River (West Alternative Coldwater River Crossing #1a), before heading up the western valley slope, eventually crossing Midday Valley Road. This part of the West Alternative is greenfield and does not parallel existing roads or utilities for approximately 4.5 km. The initial greenfield portion of the West Alternative ends at Midday Valley Road. At approximately AK 5.02, the West Alternative begins to run parallel with a TELUS FOTS buried cable. At approximately AK 8.4, the West Alternative turns south and aligns with two Enbridge (Spectra) pipelines and continues south, paralleling either the Enbridge pipelines or the TELUS FOTS cable as it crosses the Coldwater River at the south end of the West Alternative (West Alternative Coldwater River Crossing #2) and re-joins the Approved Corridor at KP 946.88.4.

Trans Mountain is proposing two trenchless crossings of the Coldwater River – one at the north end and one at the south end of the West Alternative. The southern crossing of the Coldwater River will utilize horizontal directional drill (HDD) crossing methods, with the contingency crossing method being Direct Pipe® Installation (DPI). The northern crossing will be constructed via DPI and, as a contingency should the DPI prove infeasible, micro-tunnelling. Trans Mountain's primary considerations are to install the crossing in a manner that avoids disturbance to the Coldwater River, while also reducing the technical risks of the crossing based on the geotechnical conditions.

2.2 Justification of Proposed Amendment

Based on the results of the West Alternative Environmental and Socio-economic Assessment (ESA), geotechnical and engineering assessments, Trans Mountain determined that the West Alternative is technically feasible and will result in similar environmental effects to the Approved Corridor. Through its engagement with Coldwater Indian Band and other parties, Trans Mountain understands that no Indigenous groups or stakeholders have expressed opposition to the West Alternative. Importantly, Coldwater Indian Band has confirmed that the West Alternative addresses its concerns regarding potential impacts to the aquifer relied on by the Coldwater Indian Band Community and that, subject to further community engagement, it is supportive of the West Alternative and the CER Variance Application.

2.3 Schedule

To meet the current December 2022 in-service date for the TMEP, construction mobilization and clearing is scheduled to commence in the Coldwater Valley by August 2021. Further details regarding Trans Mountain's scheduling expectations are provided in the cover letters to the CER Variance Application and this Amendment Application.

3.0 ENVIRONMENTAL ASSESSMENT OF COLDWATER WEST ALTERNATIVE REROUTE

The environmental and socio-economic issues and concerns along the West Alternative are consistent with those associated with the construction and operation of the Project along the Approved Corridor. These were identified and assessed in the original ESA and related filings, including Volumes 5A and 5B of the Facilities Application (Filing ID A56004), ESA Update (Filing ID A4F4Z3) and responses to NEB Information Request No. 2.041 (Filing ID A3Z4T9) and Information Request No. 3.025 (Filing ID A4H1V2). The assessment team – comprised of independent and qualified technical professionals – reviewed the setting (current state of the environment) for each of the biophysical and socio-economic elements to evaluate whether the West Alternative could have any new or unique interactions that would change the indicators, potential or residual effects, cumulative effects or significance conclusions of the original ESA and related filings. The review and assessment considered not only the information collected during the original ESA and related filings but also the information collected since. This included new critical habitat information, new consultation feedback, the NEB Recommendation Report (A77045), the Reconsideration Hearing

(MH-052-2018) and Phase III Consultation (Government of Canada 2019). The assessment considered whether any of the new information affected the conclusions of the original ESA and related filings.

3.1 ESA Approach

The approach taken in the ESA for the West Alternative was to:

- review and update information collected for the Project, focusing on the West Alternative;
- prepare environmental resource maps depicting the proposed West Alternative;
- determine if any additional surveys or studies are needed;
- determine if there is a change to potential residual effects as a result of the West Alternative;
- identify mitigation measures that are beyond those identified in the BC EAO review; and
- confirm inclusion of updated mitigation in the Project Environmental Plans.

The original ESA (Filing ID A56004) concluded that with implementation of the mitigation presented in the Application and related filings, the predicted Project-related residual and cumulative effects of the Project construction and operation are not significant for all of the terrestrial biophysical and socio-economic indicators assessed.

3.2 Environmental and Socio-economic Assessment Findings

The interaction of the West Alternative with the physical and socio-economic indicators assessed in the original Application is described in detail in the ESA prepared for the CER (Appendix C). Tables 1 and 2 in the CER s. 190 Application (Filing ID C08844) provide the new settings information for the West Alternative and an interactions table with assessment conclusions.

The West Alternative encounters four new environmental features that were not encountered by the Approved Corridor; however, these features were identified and addressed in the original respective element-specific assessment.

1. The West Alternative encounters lands considered to have a medium risk for natural hazard potential. Terrain stability and natural hazard (*e.g.,* rock fall, debris flow, debris floods, floods, channel changes, rock avalanches) mapping completed for the West Alternative identified glaciofluvial, fluvial, till, colluvial, glaciolacustrine, anthropogenic and organic surface materials and bedrock (BGC 2020). This risk can be mitigated through use of trenchless construction methods to pass below these hazards and/or with monitoring tools.
2. The West Alternative crosses the Coldwater River in two locations. Trans Mountain is proposing two trenchless crossings of the Coldwater River. The first crossing will use DPI with a contingency of micro-tunnelling. The second crossing of the Coldwater River will be an HDD, with a contingency to use DPI. No instream work will be required at the West Alternative Coldwater River Crossing #2, however, pending engineering design studies a temporary multi-span bridge may be required to support installation of the pipe at the West Alternative Coldwater River Crossing #1a. If a temporary multi-span bridge is required, the appropriate permits and authorizations will be obtained. The installation of a temporary vehicle crossing structure may disrupt watercourse users at the West Alternative Coldwater River Crossing #1a. While the Coldwater River is not included in Transport Canada's List of Scheduled Waters, it is considered navigable based on its characteristics (*e.g.*, deep wet depth and wide wet depth) that make it suitable for navigational purposes.
3. Two wildlife species with critical habitat (one identified and one proposed) have been identified along the West Alternative. The West Alternative crosses several Wildlife Habitat Areas (WHAs) for Williamson's sapsucker that were not previously crossed by the Project. Most of the length of these WHAs overlaps with critical habitat for Williamson's sapsucker as identified by Environment and

Climate Change Canada (ECCC). The mitigation and habitat restoration measures identified in the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan (Filing ID A6C7I3) will be implemented in areas of critical habitat for Williamson's sapsucker where the biophysical attributes are present, consistent with the approach for areas of critical habitat crossed by the original alignment. Early Draft critical habitat mapping for western screech-owl is not currently available along the West Alternative. However, if critical habitat mapping for western screech-owl is received from ECCC and overlaps with the West Alternative, mitigation and habitat restoration measures will be implemented per the Western Screech-owl Mitigation and Habitat Restoration Plan (Filing ID A6C7J8). Field studies to identify site-specific locations of biophysical attributes (*e.g.*, suitable nest trees and colonies of aphid tending ants) and species-specific surveys for Williamson's sapsucker were completed along the West Alternative during the appropriate survey period in June 2020 to inform mitigation.

4. The West Alternative centreline is approximately 77 m from a water supply well. The Groundwater Management Plan in the Environmental Protection Plan (EPP) outlines measures to protect and monitor groundwater during construction. Water well (Tag #115219) is licensed under the BC *Water Sustainability Act* to divert groundwater for livestock watering use.

The original ESA (Filing ID A56004) and related filings (Table 2) concluded that with implementation of the mitigation presented in the Application, the predicted residual and cumulative effects of Project construction and operation are not significant for all of the terrestrial biophysical and socio-economic indicators assessed. There are no new or unique interactions with the environmental and socio-economic elements identified as a result of the West Alternative.

The assessment team reviewed the West Alternative and determined that it will not change the effects assessment criteria or significance conclusions of the original ESA and related filings. The assessment concludes that with the appropriate mitigation, the predicted Project-related effects and cumulative effects of the proposed variance are not significant.

3.3 Effect on British Columbia Environmental Assessment Office Certificate Conditions

Certificate Conditions in Schedule B of the EAC E17-01 potentially affected by the amendment request are those that would involve matters and concerns pertaining to the West Alternative or would include descriptions of site-specific biophysical and socio-economic features identified in Table 1 of the CER s. 190 Application (Filing ID C08844). Appendix D to this Amendment Application provides a detailed plan for how Trans Mountain intends to address EAC Condition compliance requirements relevant to the West Alternative, which may require concurrent review with the Amendment Application. In the event the BC EAO requires a different approach to Condition compliance than that set out in Appendix D, Trans Mountain respectfully requests notice of those requirements as soon as possible.

Conditions 10, 14, 16, 17, 22, 27 and 30 have previously been satisfied. Trans Mountain will provide updates or supplements to these Condition filings. Conditions 28, 29, 32 and 33 filings will be prepared at timelines specified in the EAC E17-01 and will include information pertaining to the West Alternative as appropriate. To the extent that this timing does not align with the timing requirements in Condition wording, Trans Mountain respectfully requests amendment of those timing requirements insofar as they relate to the West Alternative or, alternatively, expedited review of the compliance filings by the EAO to facilitate the planned West Alternative construction schedule.

The purpose of Condition 25 was to address Coldwater Indian Band's concerns regarding contamination risks posed by the Approved Corridor to the aquifer beneath the Coldwater IR. The proposed West Alternative addresses Coldwater Indian Band's concerns with respect to potential risks to the aquifer, and, therefore, Condition 25 would no longer be required if the Amendment Application is approved. Trans Mountain therefore requests removal of Condition 25 from the Certificate as part of this Amendment Application.

3.4 Regulatory Context

3.4.1 Federal and Provincial Regulatory Authorizations

Trans Mountain has identified Federal and Provincial authorizations/permits required for the West Alternative in Appendix B.

3.4.2 Section 25 of the British Columbia Environmental Assessment Act

A new BC *EAA* received royal assent in November 2018 and came into force on December 19, 2019. Section 25 of the 2018 BC *EAA* defines assessment matters that must be considered, and some of these are new and were not previously considered for this Project. This Amendment Application for the proposed West Alternative addresses all assessment matters in Section 25 of the BC *EAA*, to the extent that these matters apply to the proposed West Alternative.

Section 25 of the BC *EAA* lists assessment matters that must be considered in every assessment. Table 0-2 summarizes the Section 25 assessment matters included in the BC *EAA* and where they are addressed in this Amendment Application or in the CER s. 190 Application (Filing ID C08844). Most of the Section 25 assessment matters under the 2018 BC *EAA* are consistent with the scope of the original ESA and related filings, and the CER s. 190 Application for the proposed amendment (Table 0-2).

The Section 25 assessment matters that were not directly assessed but were considered in the original ESA and related filings, and the CER s. 190 Application for the proposed amendment include:

- disproportionate effects on distinct human populations, including populations identified by gender;
- effects on biophysical factors that support ecosystem function; and
- effects on current and future generations.

The assessment approach for each of these three topics are included in the following subsections 3.5 to 3.7, which considered guidance in the BC EAO Effects Assessment Policy (BC EAO 2020).

3.5 Disproportionate Effects on Distinct Human Populations

The analysis of disproportionate effects on distinct human populations used available baseline information to identify and describe potential subpopulations within the study area which includes communities where it can be reasonably expected that direct and identifiable effects from the proposed amendment will occur. The potential residual effects identified in the CER s 190 Application that apply to the proposed amendment were also analyzed for potential socio-economic effects that may interact with distinct subpopulations. Qualitative information collected through engagement with stakeholders and Indigenous groups was used to further identify existing socio-economic patterns and the potential for Project-specific interactions, as they relate to distinct subpopulations within the communities that are potentially affected by the proposed West Alternative.

The Socio-Economic Technical Report (Volume 5D [Filing ID A56011]) of the original ESA provided various background and demographic information that contributes to understanding distinct human populations that may be affected by the Project, including Indigenous women and children. The information included in the Socio-Economic Technical Report of the original ESA outlined the local and regional economic context, biological gender identification (*e.g.,* male/female), Indigenous identification, age group, income, labour force participation and educational attainment. Interactions and potential effects on social and cultural well-being, human occupancy and resource use (HORU), infrastructure and services, employment and economy, and community health elements which contain distinct human populations were assessed in the original ESA (Section 7.0 of Volume 5B [Filing ID A3S1S9]) and related filings. The effect on Aboriginal (Indigenous) culture was considered in the original ESA. As indicated in Sections 3.1 and 3.2 of the CER s. 190 Application for the West Alternative (Filing ID C08844), information on social and cultural well-being, HORU, infrastructure and services, employment and economy and community health considered in the original ESA do not materially change for the proposed amendment. No new or unique interactions between the West Alternative and these socio-economic elements have been identified. The predicted Project-related effects of the West Alternative and cumulative effects on social and cultural well-being, HORU, infrastructure and services, employment and economy and community health elements are not significant.

Measures described in filings made with BC EAO and CER to address the requirements of the current Project-specific EAC Condition 23 (Worker Accommodation Strategy) of the Certificate E17-01 and CER Conditions (*e.g,* Condition 13: Socio-economic Effect Monitoring Plan, and Condition 59: Worker Accommodation Strategy) of the Certificate OC-065 that are potentially applicable to the proposed amendment are anticipated to reduce or alleviate potential effects on distinct human populations.

3.6 Biophysical Factors that Support Ecosystem Function

Potential effects on biophysical factors (*e.g.,* vegetation, fisheries, wetlands, wildlife and wildlife habitat and soils) that support ecosystem function were assessed for various spatial boundaries, including ecosystem, landscape- or watershed-scale analysis where feasible, in the original ESA (Volume 5A [Filing ID A56004]), in Responses to Information Request No. 2.051 (Filing ID A3Z4T9), in Responses to Information Request No. 3.025 (Filing ID A4H1V2), and in Section 3.2 of the CER s. 190 Application for the West Alternative (Filing ID C08844). Indicators for effects assessment have been selected to be representative for function of landscape (*e.g.*, vegetation and wetland indicators), watershed (*e.g.,* water quality and quantity, fish and fish habitat indicators) and ecosystem (*e.g.,* wildlife and wildlife habitat indicators).

Examples of ecosystem-, landscape- or watershed-scale analysis that were conducted include: quantification of stream crossing, riparian and instream habitat metrics for each watershed intersected by the Approved Route (Section 8.6 in Volume 5A [Filing IDs A3S1R1 and A3S1R2]); quantification of disturbance by Ecosystem Unit, designated caribou range, and designated grizzly bear population unit (Section 8.9 in Volume 5A [Filing ID A3S1R2]); and wetland landscape functional assessment (Responses to Information Request No. 2.051 [Filing ID A3Z4T9]).

As described in the original ESA (Volume 5A [Filing ID A56004]), the evaluation of residual effects of the Project considered the objectives or goals of applicable land and resource use management plans (refer to Appendix 7.1 in Volume 5A [Filing ID A56004]). Most of these management plans contain goals and strategies to conserve water use and improve water quality for watershed management, to protect aquatic and terrestrial ecosystems, and to maintain environmental, social and economic sustainability.

Baseline conditions of the West Alternative related to biophysical factors (*e.g.,* vegetation, fisheries, wetlands, wildlife and wildlife habitat, and soils) that support ecosystem function are provided in the biophysical technical reports of the CER s. 190 Application for the West Alternative (Filing ID C08844) (Appendices A to E of the CER s 190 Application). The West Alternative encounters four new environmental features that were not encountered by the Approved Corridor; however, these types of features are encountered elsewhere by the Project and are considered to be included in the original respective element-specific assessment for the TMEP. Therefore, no new or additional potential interactions or effects on biophysical factors that support ecosystem function are anticipated to occur as a result of the West Alternative. The mitigation and monitoring commitments outlined in Section 3.2 of the CER s. 190 Application are anticipated to reduce or alleviate potential effects on biophysical factors that support ecosystem function. The post-construction monitoring follow-up programs and the associated EAC Conditions (*e.g.,* Condition 16 – Wildlife Species at Risk Mitigation and Offset Plan) of the Certificate and CER Condition Plans (*e.g.,* Condition 44 - Wildlife Species at Risk Mitigation and Habitat Restoration Plans, Condition 130 - Groundwater Monitoring Program, Condition 41 - Wetland Survey and Mitigation Plan, Condition 71 - Riparian Habitat Management Plan, Condition 76 - Old Growth Management Areas Mitigation and Replacement Plan, Condition 154 - Riparian Habitat Reclamation Evaluation Report and Offset Plan, Condition 156 - Wetland Reclamation Evaluation Report and Offset Plan) are considered to further evaluate effectiveness of mitigation intended to protect ecosystem function.

Based on the assessment of predicted residual effects and the significance conclusions of residual and cumulative effects on those biophysical factors as described in Section 3.2 of the CER s. 190 Application for the West Alternative, it is predicted that ecosystem-, landscape- or watershed-level effects of the proposed amendment on biophysical factors that support ecosystem function are not significant.

3.7 Effects on Current and Future Generations

The potential effects of the proposed amendment on current generations were assessed in the CER s. 190 Application as effects on biophysical and socio-economic elements and were predicted to be not significant (refer to Table 2 in the CER s. 190 Application [Filing ID C08844]). The analysis of effects on future generations considers potential residual effects that were assessed to have long-term duration or to have reversibility characterized as long-term or permanent. For biophysical and socio-economic elements (*e.g.,* greenhouse gas [GHG] emissions, soil and soil productivity, fish and fish habitat, wetland function, vegetation, wildlife and wildlife habitat, Traditional Land and Resource Use [TLRU], HORU, social and cultural well-being and community health) that potentially have long-term or permanent residual effects on current and future generations as well as Indigenous interests, including section 35 rights, the conditions for the proposed amendment are comparable to the existing conditions assessed in the original ESA (Section 7.0 of Volume 5B [Filing ID A3S1S9]) and related filings. The residual effects of the Project on those biophysical and socio-economic elements were predicted to be not significant. No new or unique interactions between the West Alternative and those biophysical and socio-economic elements have been identified. In addition, Coldwater Indian Band confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community.

The proposed amendment does not result in any material change to the assessment of potential adverse effects, mitigation, or residual effects for GHG emissions, soil and soil productivity, fish and fish habitat, wetland function, vegetation, wildlife and wildlife habitat, TLRU, HORU, social and cultural well-being and community health elements during any phase of the Project. As a result, there are no anticipated significant effects to community or Indigenous future generations.

The Project, including the proposed amendment will provide positive benefits by means of employment, government revenues, and economic development and diversification for the Regional and Local communities. These economic benefits were assessed in the original ESA (Section 7.0 of Volume 5B [Filing ID A3S1S9]). Trans Mountain expects that the benefits of the Project to future generations would be sustained for the life of the Project and into the future.

4.0 STAKEHOLDER CONSULTATION

Trans Mountain is committed to ongoing engagement with stakeholders throughout the life of the Project, including the proposed amendment. Stakeholder engagement updates regarding the West Alternative are provided in Sections 2.0 and 2.1 of the CER s. 190 Application for the West Alternative (Filing ID C08844).

5.0 INDIGENOUS ENGAGEMENT

Trans Mountain has continued to actively engage with Indigenous groups that have been identified as having an interest in the Project, including the West Alternative, or having Indigenous interests potentially affected by the Project, including the West Alternative. Trans Mountain will continue its engagement with Indigenous groups throughout the BC EAO's process and other applicable regulatory and permitting process, and into Project construction and operations. Indigenous engagement updates specific to the West Alternative are provided in Sections 2.0 and 2.2 of the CER s. 190 Application for the West Alternative (Filing ID C08844).

Since May of this year, Trans Mountain President and CEO, Ian Anderson, has been meeting regularly with Chief Lee Spahan of Coldwater Indian Band, attempting to reach consensus on routing. In early October, Coldwater Indian Band confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community. Subject to further engagement with the Coldwater Indian Band Community, Chief Spahan and Council have confirmed their support for the proposed West Alternative and the CER Variance Application.

In addition to its engagement with Coldwater Indian Band, Trans Mountain has engaged with other potentially affected Indigenous groups regarding the West Alternative. From this engagement, Trans Mountain understands that no Indigenous groups oppose the West Alternative.

6.0 CONCLUSION

The approximately 18.4 km long Coldwater West Alternative Reroute deviates from the Approved Corridor at KP 931.4, re-joining at KP 946.9. An Application for Variance under Section 190 of the *CER Act* was required to vary the Certificate of Public Convenience and Necessity to reflect changes to the previously approved TMEP corridor. In addition, an amendment to EAC E17-01 issued on January 10, 2017 is required to vary the certified project corridor. The assessment team reviewed the proposed variance and determined that interactions, potential effects, mitigation measures and residual and cumulative effects related to the West Alternative are similar to those identified during the original ESA (Volumes 5A and 5B of the Facilities Application) (Filing ID A56004) and related filings.

In early October, Coldwater Indian Band confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Indian Band Community. Trans Mountain has engaged Coldwater Indian Band, all other potentially affected Indigenous groups, landowners and other stakeholders regarding the West Alternative and is not aware of any opposition to the proposed West Alternative. Subject to further engagement with the Coldwater Indian Band Community, Chief Spahan and Council have confirmed their support for the proposed West Alternative and the CER Variance Application. In light of these engagement outcomes Trans Mountain is respectfully requesting approval of this Amendment Application.

7.0 REFERENCES

7.1 Personal Communications

Donavan, M. British Columbia Conservation Data Centre. 2020. Personal communication (email) with Tyler Innes, Jacobs. July.

7.2 Literature Cited

British Columbia Environmental Assessment Office (BC EAO). 2020. Effects Assessment Policy. Version 1.0. April 2020. Accessed September 2020. https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/environmental-assessments/guidance-documents/2018-act/effects_assessment_policy_v1_-_april_2020.pdf

7.3 GIS References

This subsection includes references cited on the figures accompanying this report.

BC Ministry of Environment and Climate Change Strategy. 2020. BC Wildlife Habitat Areas - Approved (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-approved. Acquired: Acquired June 16, 2020.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. Old Growth Management Areas, legal (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/old-growth-management-areas-legal-current. Acquired July 7, 2020.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2020. Ungulate Winter Range, Approved (digital file). Available: https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-approved. Acquired June 16, 2020.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2019. Municipalities - Legally Defined Administrative Areas of BC (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/municipalities-legally-defined-administrative-areas-of-bc. Acquired: December 2019.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2019. Railway Track Line (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/railway-track-line. Acquired: November 29, 2019.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2019. Tantalis Parks, Ecological Reserves and Protected Areas (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/bc-parks-ecological-reserves-and-protected-areas. Acquired: March 11, 2019.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2018. Freshwater Atlas Lakes (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-lakes. Acquired: January 2018.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2018. Freshwater Atlas Rivers (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-rivers. Acquired: January 2018.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2015. Digital Road Atlas (DRA) - Master Partially Attributed Road Data (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/digital-road-atlas-dra-master-partially-attributed-roads. Acquired: December 15, 2015.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2011. BCGS 1:20,000 Grid (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: August 2011.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2011. Freshwater Atlas Stream Network (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-stream-network. Acquired: August 18, 2011.

ESRI. 2020. World Imagery map service (digital file). Redmond, WA. Available: via ArcGIS Online, visit http://www.esri.com/software/arcgis/arcgisonline. Web Map Service Layer Credits: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community (c) 2020 ESRI and its data suppliers. Accessed Online October 5, 2020.

ESRI. 2006. Canada Provincial Boundaries (digital data). Redlands, CA. Received: via DVD with ArcGIS software, visit http://www.esri.com/data/data-maps for more info. Acquired: September 2006.

Government of Canada. 2019. Aboriginal Lands, Canada (digital file). Edmonton, AB. Available: http://open.canada.ca/data/en/dataset/522b07b9-78e2-4819-b736-ad9208eb1067 Acquired: December 6, 2019.

IHS Inc. 2020. IHS Enhanced Pipeline Data (digital file). Calgary, AB. Received: via FTP at https://ftga.ihs.com/webclient/WebClient.jsf, visit http://www.ihs.com for more info. Acquired: March 6, 2020.

Kinder Morgan Canada. 2016. Facilities (digital file). Calgary, AB. Received via FTP. Acquired: August 24, 2016.

Natural Resources Canada. 2017. National Road Network – Alberta (digital file). Sherbrooke, QC. Available: http://ftp.geogratis.gc.ca/pub/nrcan_rncan/vector/geobase_nrn_rrn. Acquired: June 15, 2017.

Natural Resources Canada. 2017. National Road Network – British Columbia (digital file). Sherbrooke, QC. Available: http://ftp.geogratis.gc.ca/pub/nrcan_rncan/vector/geobase_nrn_rrn. Acquired: June 15, 2017.

Natural Resources Canada. 2011. Canadian Geographical Names (digital file). Ottawa, ON. Available: http://geobase.ca/geobase/en/data/cgn/index.html. Acquired: December 2011.

Natural Resources Canada. 2011. National Topographic Data Base (NTDB) 250k Watercourses (digital file). Sherbrooke, QC. Available: http://geogratis.cgdi.gc.ca/geogratis/en/download/topographic.html. Acquired: November 23, 2011.

Natural Resources Canada. 2012. National Hydro Network (digital files). Sherbrooke, QC. Available: http://www.geobase.ca/geobase/en/data/nhn/index.html. Acquired: April 2012.

TERA Environmental Consultants. 2008. Hillshade. Derived from Natural Resources Canada, Earth Sciences Sector, Centre for Topographic Information. 2000-2008. Canadian Digital Elevation Data 250k (digital files). Sherbrooke, QC. Available: http://www.geobase.ca/geobase/en/data/cded/index.html. Acquired: 2008.

Universal Pegasus International. 2020. Proposed AKs and Centerline AR3359 (digital files). Calgary, AB. Received via FTP. Acquired: May 21, 2020.

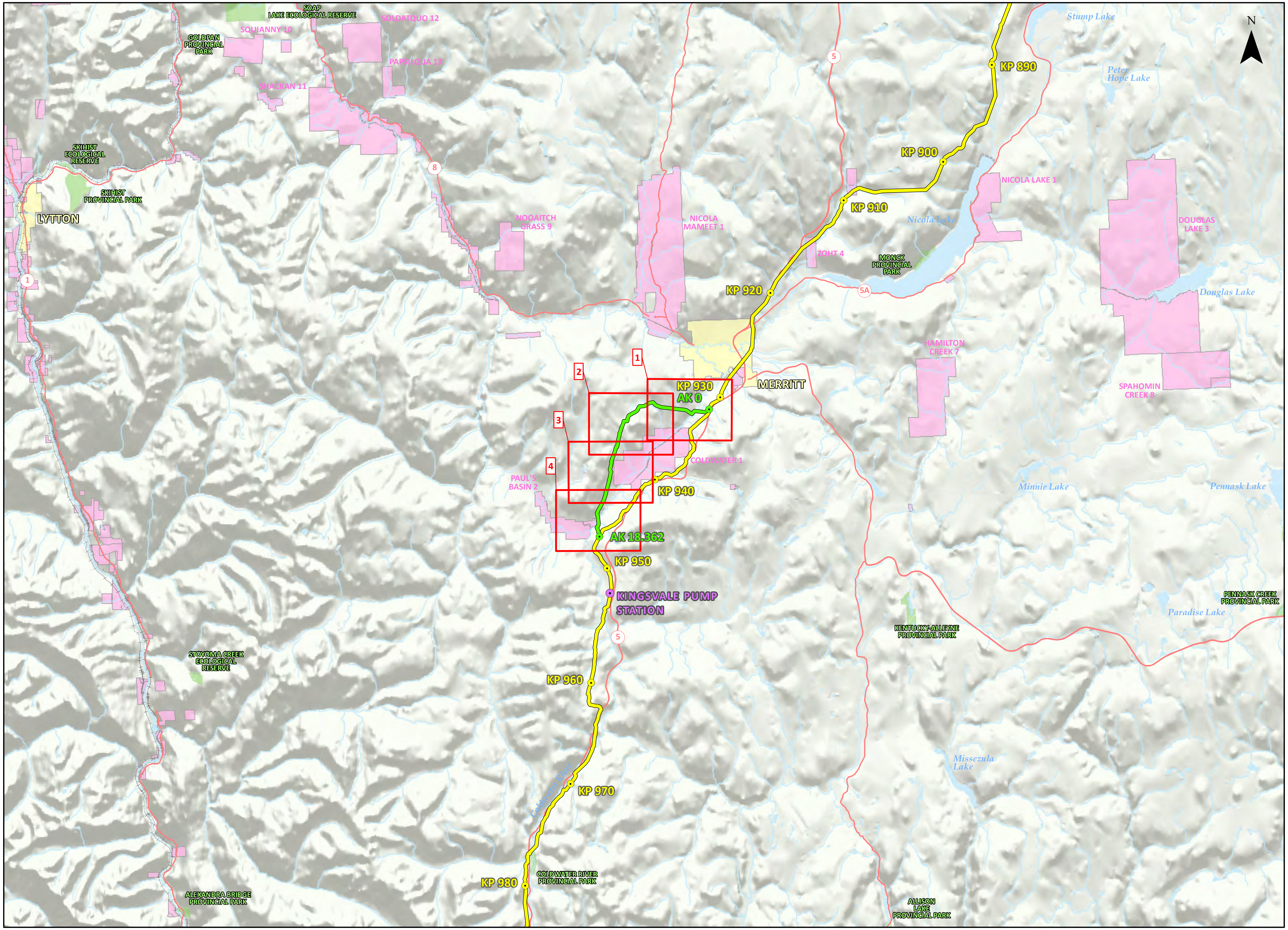
Universal Pegasus International. 2020. Proposed AKs, Centerline, and Corridor AR3360 (digital files). Calgary, AB. Received via FTP. Acquired: September 4, 2020.

Universal Pegasus International. 2018. Proposed KPs and Centerline SSEID005.19 (digital files). Calgary, AB. Received via FTP. Acquired: November 23, 2018.

Universal Pegasus International. 2016. NEB Preliminary Corridor V11 (digital file). Calgary, AB. Received via FTP. Acquired: April 20, 2016.

APPENDIX A

CERTIFIED PROJECT CORRIDOR MAPBOOK



TRANS MOUNTAIN EXPANSION PROJECT

CERTIFIED PROJECT CORRIDOR MAPBOOK INDEX

- 🟥 Map Sheet
- ● KP Marker (10 km)
- ● Corridor Revision AK Marker
- ● Certified Pump Station Area
- ━ Certified Pipeline Corridor
- ━ Corridor Revision Coldwater West Alternative
- ① Highway
- ┼ Railway
- 🟨 City / Town / District Municipality
- ▨ Indian Reserve
- 🟩 Park / Protected Area
- ▨ Waterbody

Trans Mountain Contact: Dave Sare (403) 206-6992
Suite 2700, 300 5th Avenue SW, Calgary, AB. T2P 5J2

This document is provided byTrans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternate AKs & Corridor Revision provided by UPI September 2020; Certified Pipeline Corridor provided by UPI April 2016; Certified Pipeline Corridor KPs (SSEID005.19) provided by UPI November 23, 2018; Facilities provided by KMC Dec 2, 2016; Transportation: BC MFLNRO 2019, NRCan 2015; Geopolitical Boundaries: BC MFLNRO 2019, NRCan 2011, ESRI 2005; First Nation Lands: Government of Canada 2019; Parks and Protected Areas: NRCan 2017, BC MFLNRO 2008; Hydrology: BC MFLNRO 2019, NRCan 2010; Hillshade: TERA Environmental Consultants 2008.

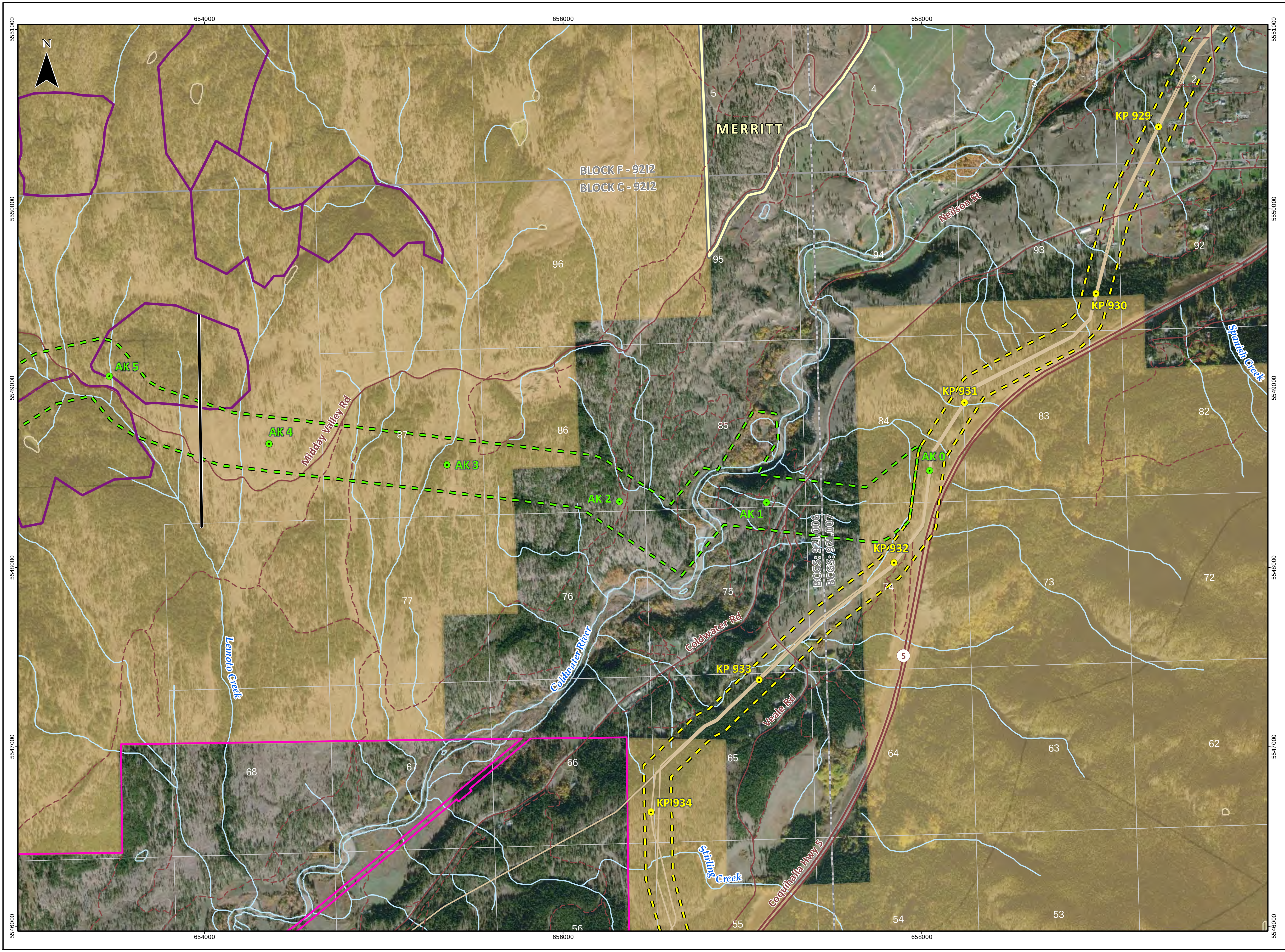
Prepared by Jacobs
Suite 330, 205 Quarry Park Blvd. SE, Calgary, AB. T2C 3E7

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 201610_MAP_CH2M_PER_00947_REV1		PAGE SHEET 1 OF 1
DATE October 2020	REFERENCE CE771600	REVISION 1
SCALE 1:300,000	PAGE SIZE 11x17	DISCIPLINE PER
DRAWN CMR	CHECKED DJN	DESIGN CMR

ALL LOCATIONS APPROXIMATE

201610_MAP_CH2M_PER_00947_Rev1.mxd



TRANS MOUNTAIN EXPANSION PROJECT

CERTIFIED PROJECT CORRIDOR MAPBOOK

- Start/End Map Sheet Marker
- KP Marker
- Corridor Revision AK Marker
- Certified Pipeline Corridor
- Corridor Revision
  Coldwater West Alternative
- Highway
- Paved Road
- Resource Road
- Railway
- Existing Pipeline
- City / Town / District Municipality
- Indian Reserve
- Ungulate Winter Range
- Waterbody / Watercourse
- Wildlife Habitat Area

Trans Mountain Contact: Dave Sare (403) 206-6992
Suite 2700, 300 5th Avenue SW, Calgary, AB. T2P 5J2

This document is provided byTrans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternate AKs & Corridor Revision provided by UPI September 2020; Certified Pipeline Corridor provided by UPI April 2016; Certified Pipeline Corridor KPs (SSEID005.19) provided by UPI November 23, 2018; Transportation: BC MFLNRO 2012, NRCan 2015; Existing Infrastructure: IHS Inc. 2020; Geopolitical Boundaries: BC MFLNRO 2019, NRCan 2011, ESRI 2005; First Nation Lands: Government of Canada 2019; Ungulate Winter Ranges, Wildlife Habitat Areas: BC MFLNRO 2020; Hydrology: BC MFLNRO 2014; BCGS Grid: BC MFLNRO 2003; NTS Grid & PNG Grid: TERA Environmental Consultants, 2008 & 2009; Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Prepared by Jacobs
Suite 330, 205 Quarry Park Blvd. SE, Calgary, AB. T2C 3E7

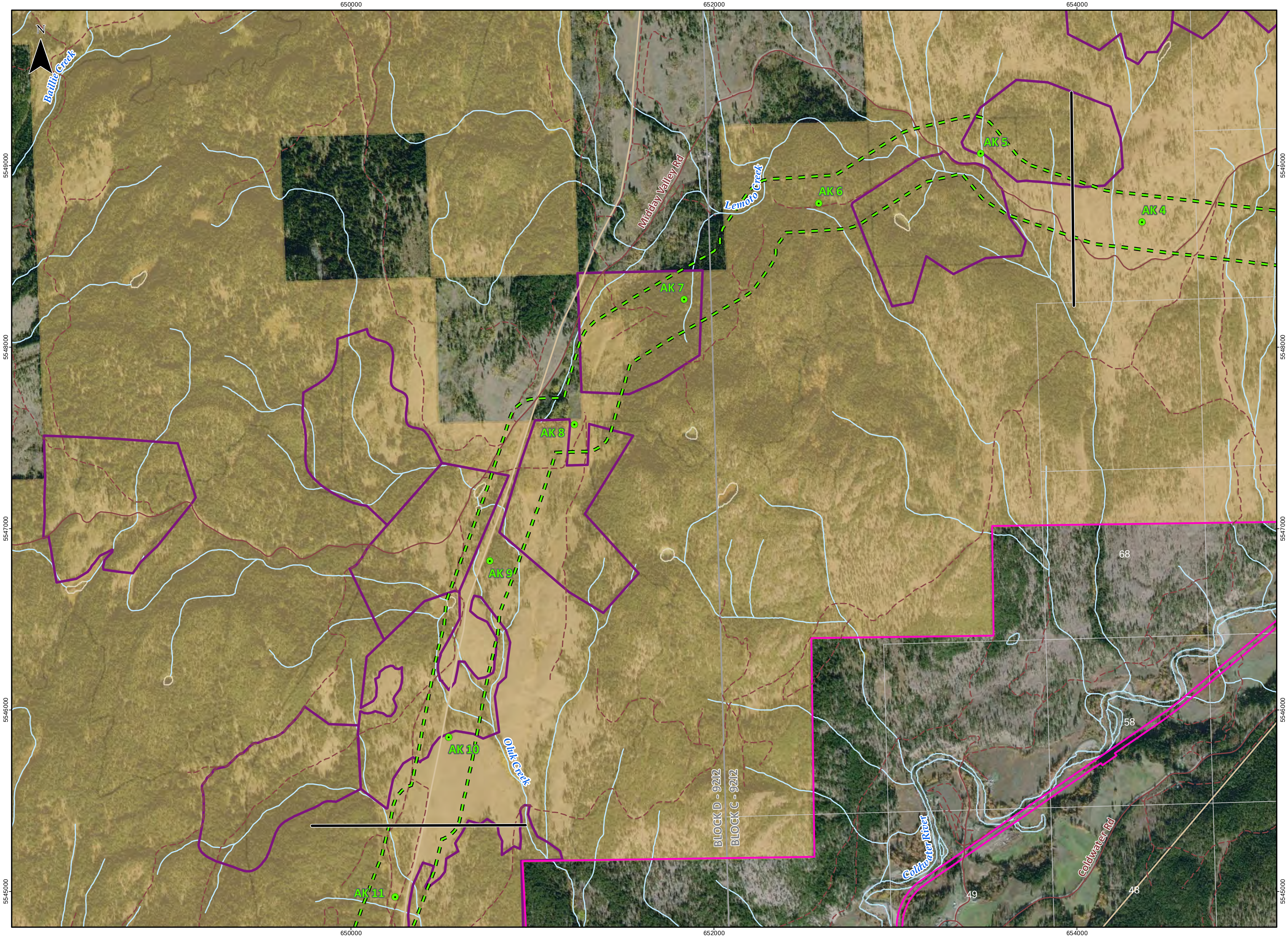
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 201605_MAP_CH2M_PER_00920_REV3		PAGE SHEET 1 OF 4
DATE October 2020	REFERENCE CE771600	REVISION 3
SCALE 1:20,000	PAGE SIZE 11x17	DISCIPLINE PER
DRAWN CMR	CHECKED DJN	DESIGN DJN

0 200 400 600 800 m

ALL LOCATIONS APPROXIMATE

\\jacobs.com\common\Shares\CNR\GIS-TMEP\MAP_FILES\PER\201605_MAP_CH2M_PER_00920\Rev3\201605_MAP_CH2M_PER_00920_Rev3.mxd



TRANS MOUNTAIN EXPANSION PROJECT

CERTIFIED PROJECT CORRIDOR MAPBOOK

- ▬ Start/End Map Sheet Marker
- ● KP Marker
- ● Corridor Revision AK Marker
- ▭ Certified Pipeline Corridor
- ▭ Corridor Revision Coldwater West Alternative
- ① Highway
- — Paved Road
- - - Resource Road
- ┼ Railway
- — Existing Pipeline
- ▭ City / Town / District Municipality
- ▭ Indian Reserve
- ▭ Ungulate Winter Range
- ▭ Waterbody / Watercourse
- ▭ Wildlife Habitat Area

Trans Mountain Contact: Dave Sare (403) 206-6992
Suite 2700, 300 5th Avenue SW, Calgary, AB. T2P 5J2

This document is provided byTrans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternate AKs & Corridor Revision provided by UPI September 2020; Certified Pipeline Corridor provided by UPI April 2016; Certified Pipeline Corridor KPs (SSEID005.19) provided by UPI November 23, 2018; Transportation: BC MFLNRO 2012, NRCan 2015; Existing Infrastructure: IHS Inc. 2020; Geopolitical Boundaries: BC MFLNRO 2019, NRCan 2011, ESRI 2005; First Nation Lands: Government of Canada 2019; Ungulate Winter Ranges, Wildlife Habitat Areas: BC MFLNRO 2020; Hydrology: BC MFLNRO 2014; BCGS Grid: BC MFLNRO 2003; NTS Grid & PNG Grid: TERA Environmental Consultants, 2008 & 2009; Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Prepared by Jacobs
Suite 330, 205 Quarry Park Blvd. SE, Calgary, AB. T2C 3E7

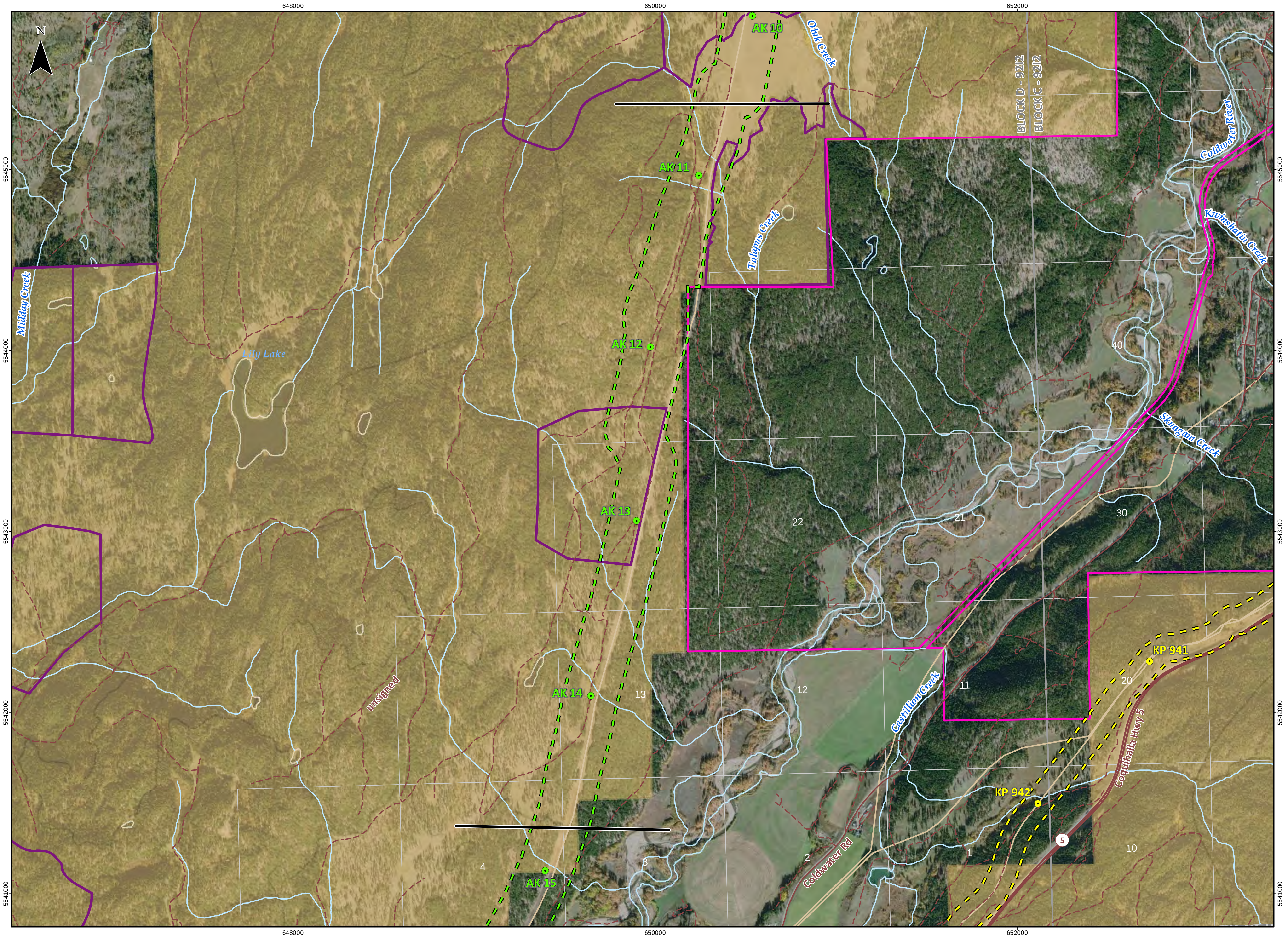
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 201605_MAP_CH2M_PER_00920_REV3		PAGE SHEET 2 OF 4
DATE October 2020	REFERENCE CE771600	REVISION 3
SCALE 1:20,000	PAGE SIZE 11x17	DISCIPLINE PER
DRAWN CMR	CHECKED DJN	DESIGN DJN

0 200 400 600 800 m

ALL LOCATIONS APPROXIMATE

\\jacobs.com\common\Shares\CNR\GIS-TMEP\MAP_FILES\PER\201605_MAP_CH2M_PER_00920\Rev3\201605_MAP_CH2M_PER_00920_Rev3.mxd



TRANS MOUNTAIN EXPANSION PROJECT

CERTIFIED PROJECT CORRIDOR MAPBOOK

▬	Start/End Map Sheet Marker
●	KP Marker
●	Corridor Revision AK Marker
▭	Certified Pipeline Corridor
▭	Corridor Revision Coldwater West Alternative
①	Highway
—	Paved Road
- -	Resource Road
┼	Railway
—	Existing Pipeline
▭	City / Town / District Municipality
▭	Indian Reserve
▭	Ungulate Winter Range
▭	Waterbody / Watercourse
▭	Wildlife Habitat Area

Trans Mountain Contact: Dave Sare (403) 206-6992
Suite 2700, 300 5th Avenue SW, Calgary, AB. T2P 5J2

This document is provided byTrans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternate AKs & Corridor Revision provided by UPI September 2020; Certified Pipeline Corridor provided by UPI April 2016; Certified Pipeline Corridor KPs (SSEID005.19) provided by UPI November 23, 2018; Transportation: BC MFLNRO 2012, NRCan 2015; Existing Infrastructure: IHS Inc. 2020; Geopolitical Boundaries: BC MFLNRO 2019, NRCan 2011, ESRI 2005; First Nation Lands: Government of Canada 2019; Ungulate Winter Ranges, Wildlife Habitat Areas: BC MFLNRO 2020; Hydrology: BC MFLNRO 2014; BCGS Grid: BC MFLNRO 2003; NTS Grid & PNG Grid: TERA Environmental Consultants, 2008 & 2009; Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Prepared by Jacobs
Suite 330, 205 Quarry Park Blvd. SE, Calgary, AB. T2C 3E7

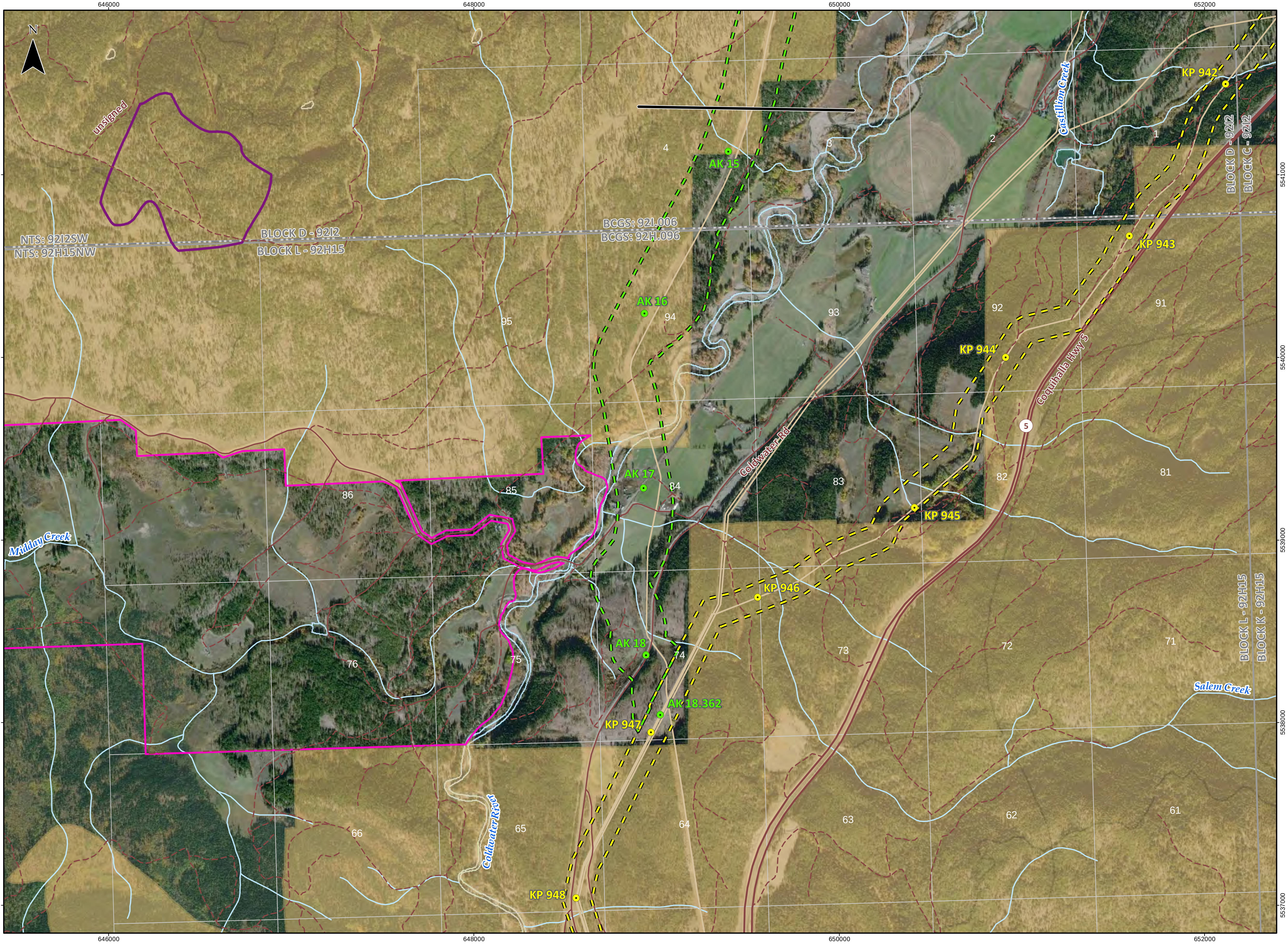
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 201605_MAP_CH2M_PER_00920_REV3		PAGE SHEET 3 OF 4
DATE October 2020	REFERENCE CE771600	REVISION 3
SCALE 1:20,000	PAGE SIZE 11x17	DISCIPLINE PER
DRAWN CMR	CHECKED DJN	DESIGN DJN

0 200 400 600 800 m

ALL LOCATIONS APPROXIMATE

\\jacobs.com\common\Shares\CNR\GIS-TMEP\MAP_FILES\PER\201605_MAP_CH2M_PER_00920\Rev3\201605_MAP_CH2M_PER_00920_Rev3.mxd



TRANS MOUNTAIN EXPANSION PROJECT

CERTIFIED PROJECT CORRIDOR MAPBOOK

- ▬ Start/End Map Sheet Marker
- ● KP Marker
- ● Corridor Revision AK Marker
- ▨ Certified Pipeline Corridor
- ▨ Corridor Revision Coldwater West Alternative
- ① Highway
- — Paved Road
- - - Resource Road
- ┼ Railway
- — Existing Pipeline
- ▭ City / Town / District Municipality
- ▭ Indian Reserve
- ▭ Ungulate Winter Range
- ▭ Waterbody / Watercourse
- ▭ Wildlife Habitat Area

Trans Mountain Contact: Dave Sare (403) 206-6992
Suite 2700, 300 5th Avenue SW, Calgary, AB. T2P 5J2

This document is provided byTrans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternate AKs & Corridor Revision provided by UPI September 2020; Certified Pipeline Corridor provided by UPI April 2016; Certified Pipeline Corridor KPs (SSEID005.19) provided by UPI November 23, 2018; Transportation: BC MFLNRO 2012, NRCan 2015; Existing Infrastructure: IHS Inc. 2020; Geopolitical Boundaries: BC MFLNRO 2019, NRCan 2011, ESRI 2005; First Nation Lands: Government of Canada 2019; Ungulate Winter Ranges, Wildlife Habitat Areas: BC MFLNRO 2020; Hydrology: BC MFLNRO 2014; BCGS Grid: BC MFLNRO 2003; NTS Grid & PNG Grid: TERA Environmental Consultants, 2008 & 2009; Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

Prepared by Jacobs
Suite 330, 205 Quarry Park Blvd. SE, Calgary, AB. T2C 3E7

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 201605_MAP_CH2M_PER_00920_REV3		PAGE SHEET 4 OF 4
DATE October 2020	REFERENCE CE771600	REVISION 3
SCALE 1:20,000	PAGE SIZE 11x17	DISCIPLINE PER
DRAWN CMR	CHECKED DJN	DESIGN DJN

ALL LOCATIONS APPROXIMATE

\\jacobs.com\common\Shares\CNR\GIS-TMEP\MAP_FILES\PER\201605_MAP_CH2M_PER_00920\Rev3\201605_MAP_CH2M_PER_00920_Rev3.mxd

APPENDIX B

FEDERAL AND PROVINCIAL PERMITS

TABLE B-1

LIST OF POTENTIAL FEDERAL REGULATORY AUTHORIZATIONS FOR THE WEST ALTERNATIVE REROUTE

Responsible Agency	Legislation	Permit/Notification	Activity/Trigger
Canada Energy Regulator	Section 190 of the *Canadian Energy Regulator Act (CER Act)*	An Order/Certificate approving the Application for Variance under Section 190 of the *CER Act*	Approval is required to vary the Certificate of Public Convenience and Necessity to reflect changes to the previously approved Application.
Fisheries and Oceans Canada (DFO)	*Fisheries Act*	Letter of Advice/Regulation Authorization	The Act requires that projects avoid causing a harmful alteration, disruption, or destruction of fish habitat, unless authorized by the Minister of DFO. The Act also has provisions that: prohibit the deposition of deleterious substances into waters used by fish; ensure the safe passage of fish; and require flow of water and passage of fish, as well as water intakes and diversions to have a fish guard or fish screen. *Note: In light of the proposed trenchless construction methods posed at fish-bearing waters, Trans Mountain does not expect that DFO authorization will be required for the West Alternative Reroute. In the unlikely event that a bridge is required to cross the Coldwater River and the bridge requires in-stream works, Trans Mountain will consult with DFO on the potential need for an authorization under the Fisheries Act.*

TABLE B-2

LIST OF BC PROVINCIAL PERMITS FOR THE WEST ALTERNATIVE REROUTE

Responsible Agency	Legislation	Permit/Notification	Activity/Trigger
Agricultural Land Commission / BC Oil and Gas Commission (BC OGC)	*Agriculture Land Commission Act (ALCA),* S.6 of the Agriculture Land Reserve (ALR) Use, Subdivision and Procedure Regulation	ALR Authorization	• To conduct any of the following on ALR: widening of an existing right-of-way, construct a road, construct a pipeline right-of-way, or a facility. • Under Section 26 of the *ALCA*, the Agricultural Land Commission (ALC) can enter into an agreement to allow certain governments or authorities to exercise the ALC's power to decide applications for non-farm use. Such agreements may also exempt a non-farm use in a specified area from the requirement of an application for permission for non-farm use on certain conditions. The ALC has exercised power to enter into an agreement with the BC OGC relating to certain oil and gas non-farm uses within ALR (BC OGC 2017), which means the BC OGC acts as the ALC and makes decisions guided by the *ALCA* and regulations.
	ALCA, S.40	Non-farm Use to Place or Remove Soil Permit	• Will require if land is not excluded from the ALR and only if bringing in fill or removing it from the ALR parcel. • Non-farm placement of fill or removal of soil from the ALR.
BC OGC	Specified Enactment Powers (Water, Land, Forests) under the *Oil and Gas Activities Act* (*OGAA*)	CER BC OGC Pipeline Application (Crown Land, License to Cut, Section 11)	• For new CER Pipeline projects, a single CER pipeline Provincial authorization application is submitted to the Commission.
	Water Sustainability Act	Section 11: Changes In and About a Stream Authorization	• Changes in and about a stream (bridge installation, ice bridge installation, large debris removal, gravel removal, construction/maintenance of a pipeline crossing).
	Land Act	Road Permit	• Issued for long-term use roads on Crown land, whether they are new, or existing deactivated and overgrown or non-status. Permit issued under the *Land Act* (not *OGAA*) for CER pipeline roads.
	Forest Act (S. 117)	Road Use Permit	• Road use permits for industrial use.
	Water Sustainability Act	Section 10: Short Term Use of Water Permit	• Short-term water withdrawal. Wetted stream width, average stream depth, stream velocity and date the measurements were taken are required. • Permits valid for 1 year.

TABLE B-2 Cont'd

Responsible Agency	Legislation	Permit/Notification	Activity/Trigger
BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development	*Forest Act*	Works Permit	• Required wherever the pipeline will be located in the right-of-way of a Forest Service Road.
	Forest Recreation Regulation	Section 16: Forest Recreation Usage	• Required for authorized use of a Forest Recreation Site.
	Wildlife Act	General permit, Animal care permit (under section 19)	• Required for field programs, and construction, operations, decommissioning and abandonment which impact wildlife habitat feature and cause an animal to come into care.
	Wildlife Act	*Wildlife Act* Exemption Permits	• A permit holder must submit a notification under Section 11 of the *Wildlife Act* to the Regional Ministry of Environment office prior to an activity that disturbs certain animals and their habitat during designated seasons or in designated regions.
	Wildlife Act	Section 40 of *Wildlife Act:* Temporary Closure to Hunting, Trapping or Guide Outfitting	• If a temporary closure to a hunting, trapping or guide outfitting area is required. • Section 40 of the *Wildlife Act* is to allow for closures of hunting seasons for population management purposes.
	Heritage Conservation Act (HCA)	Heritage Inspection Permit - Clearance	• The purpose of a heritage inspection is to assess the archaeological significance of land or other property. In this regard, the inspection determines the presence of archaeological sites which warrant protection, or are already protected, under the *HCA*. A heritage investigation is undertaken in order to recover information which might otherwise be lost as a result of site alteration or destruction.
	HCA	Heritage Alteration Permit (under section 12)	• The site alteration permit authorizes the removal of residual archaeological deposits once the inspection and investigation are completed.
BC Ministry of Transportation and Infrastructure (BC MoTI)	*Transportation Act*	Sign Permit	• Sign erection
	Section 5 of the *Industrial Roads Act*; Section 49 and 62 (1) of the *Transportation Act*	Access Permit, Highway Access Permit, Controlled Highway Access Permit	• Road Construction within Right-of-Way • Access points adjoining to a highway • Access points adjoining to a designated controlled access highway
	Transportation Act	Work Notification or Lane Closure Request Permit	• When work requires a closure of a BC MoTI right-of-way • Purpose for constructing works/altering traffic • Traffic control must be carried out by Traffic Control personnel certified in BC.
	Section 62 (1) of the *Transportation Act*	Works on the Right-of-Way (Pipeline Crossing)	• Proposed pipeline crossings will require engineered drawings signed and sealed by a design Professional engineer and geotechnical engineer. All works must comply with highway standards, policies and guidelines.
	Section 62 (1) of the *Transportation Act*	Clearing and Grubbing Permit	• Clearing and grubbing must be in compliance with BC MoTI and other applicable regulators.
	Section 62 (1) of the *Transportation Act*	Works on the Right-of-Way (Misc.)	• Required for miscellaneous activities to be undertaken in a Right-of-Way, not already covered in other permits.

APPENDIX C

SECTION 190 APPLICATION

October 9, 2020

FILED ELECTRONICALLY

Canada Energy Regulator
Suite 210, 517 10 Ave SW
Calgary, AB T2R 0A8

Attention: Mr. Jean-Denis Charlebois
Secretary of the Commission of the Canada Energy Regulator
("Commission")

Dear Mr. Charlebois:

Re: Trans Mountain Pipeline ULC ("Trans Mountain")
Trans Mountain Expansion Project ("Project")
Section 190 of the *Canadian Energy Regulator Act* ("CER Act")
Variance Application for the West Alternative Route

Please find enclosed Trans Mountain's Application to vary the alignment of the TMEP in the Coldwater Valley ("Variance Application"), which is submitted pursuant to s. 190 of the CER Act. Trans Mountain is seeking approval to vary the TMEP Certificate of Public Convenience and Necessity and related orders to reflect the proposed corridor realignment, referred to as the West Alternative Route.

This Variance Application is being filed in response to requests from the Coldwater Indian Band ("Coldwater") to re-route the approved TMEP corridor in a manner that avoids potential impacts to the aquifer beneath the Coldwater Indian Reserve No. 1 ("Reserve"), and on the basis of support or non-opposition from Indigenous communities and other stakeholders. Coldwater has had the opportunity to review the West Alternative Route and the enclosed information in discussions with Trans Mountain and have confirmed Coldwater's support of the Variance Application, subject to further engagement with the community. Trans Mountain has also engaged with all other potentially affected Indigenous groups, landowners and other stakeholders regarding the West Alternative Route and is not aware of any outstanding concerns regarding the proposed re-route. Trans Mountain will continue to engage with these parties throughout the Commission's review process and the life of the Project.

As the Commission is aware, construction of the TMEP is well underway, and the anticipated in-service date is currently no later than December 31, 2022. In order to meet this timing, construction-related activity on the West Alternative Route, including mobilization, should commence by August 2021. As discussed in the Variance Application, the West Alternative Route includes two trenchless crossings of the Coldwater River. These crossings require significant lead time and are subject to execution risks, which can prolong execution timelines. In addition, tree clearing can only practicably be achieved outside of the restricted activity period associated with migratory bird nesting (March 26 through August 17). Construction of the TMEP and related activities for the extent of the West Alternative Route are anticipated to take approximately 11 months. These construction activities must be complete prior to commencing hydrostatic testing, valve installation and commissioning activities, all of which must be done prior to commencing operations by the end of 2022.

In the event Federal Cabinet authorization is mandated, **Trans Mountain believes a recommendation from the Commission on the Variance Application to the Governor in Council is required by April 2021** to enable a Cabinet decision and, if the Variance Application is approved, an Order in Council to be issued by July 2021. An amended certificate, orders and ancillary approvals (discussed below) from the Commission would be required shortly thereafter to enable construction to commence in August 2021.

Trans Mountain respectfully requests that the Commission establish an efficient and fair process to consider the enclosed Variance Application that would facilitate this timing. Given the extensive regulatory history and precedent on the Project, the fact that the Variance Application reflects an accommodation of Indigenous concerns and the lack of express Indigenous or stakeholder opposition to the West Alternative Route to date, Trans Mountain believes that the requested 10-month processing time is achievable in the circumstances. Trans Mountain expects that this process would require coordination of Indigenous consultation efforts with the Ministry of Natural Resources Canada and the Province of British Columbia.

To support an efficient regulatory process and timely decision, Trans Mountain intends to (i) file and serve its plan, profile and book of reference ("PPBoR") for the West Alternative Route by January 31, 2021; and (ii) submit revisions or additions to applicable pre-construction Project condition compliance filings by April 30, 2021.[1] With respect to the former, Trans Mountain plans to seek approval of the PPBoR sheets as part of or in parallel with the Commission's decision or recommendation on the realignment, which approval would be conditional on Governor in Council authorization of the realignment, if required. With respect to the latter, Appendix D to the enclosed Variance Application provides a detailed plan for how Trans Mountain intends to address pre-construction condition compliance requirements relevant to the West Alternative Route, which may require concurrent review with the Variance Application. In the event the Commission requires a different approach to condition compliance than that set out in Appendix D, Trans Mountain respectfully requests notice of those requirements as soon as possible.

Trans Mountain will provide a link to this filing to all Indigenous groups and stakeholders potentially affected by the Variance Application via email within two business days of filing it with the Commission.

Should you have any questions or concerns regarding this matter, please contact the undersigned at regulatory@transmountain.com.

Yours truly,

<Original signed by>

Scott Stoness

Vice President, Regulatory and Compliance
Trans Mountain Canada Inc.

cc. Potentially Affected Indigenous Groups and Stakeholders

---

[1] As discussed in Appendix D to the Variance Application, Trans Mountain will prepare and submit updated environmental alignment sheets and resource-specific mitigation tables for the West Alternative separately and no later than one month prior to construction.

CANADA ENERGY REGULATOR

IN THE MATTER OF the *Canadian Energy Regulator Act*, ("CER Act") and regulations made thereunder;

AND IN THE MATTER OF an application by Trans Mountain Pipeline ULC ("Trans Mountain") pursuant to section 190 of the CER Act to vary the approved pipeline corridor for the Trans Mountain Expansion Project (the "Project" or "TMEP") approved under Certificate of Public Convenience and Necessity OC-065 ("Certificate OC-065").

APPLICATION OF TRANS MOUNTAIN FOR VARIANCE TO CERTIFICATE OC-065 TO ACCOMMODATE WEST ALTERNATIVE ROUTE

October 9, 2020

To: The Secretary
Canada Energy Regulator
Suite 210, 517 Tenth Ave SW
Calgary, AB T2R 0A8

I. INTRODUCTION

1. Trans Mountain hereby applies under section 190 of the CER Act to vary Certificate OC-065 and related orders issued for the TMEP to accommodate an alternate route for the Project in the Coldwater Valley. Certificate OC-065 currently approves a Project corridor ("East Route") through the Coldwater Valley that passes to the south-east of Coldwater Indian Band ("Coldwater") Indian Reserve No. 1 (the "Reserve"). In this Variance Application, Trans Mountain is requesting a realignment of the approved corridor to accommodate a TMEP route along the west side of the Coldwater Valley that passes to the north-west of the Reserve (the "West Alternative" or "Reroute"). This Variance Application is submitted in response to Coldwater's request to avoid risks to the underground water supply at the Reserve to the greatest extent possible.

II. OVERVIEW

2. This Variance Application is organized as follows:

- **Background:** a summary of the factual background relevant to this Variance Application;

- **Description of Proposed Variance:** a description of the proposed West Alternative route, proposed construction methods and associated engineering and design details;

- **Environmental and Socio-economic Assessment ("ESA"):** an assessment of the potential environmental and socio-economic impacts, including traditional land use and archaeological impacts, associated with the West Alternative, including a description of Trans Mountain's assessment methodology, data sources, mitigation measures and a comparison of ESA conclusions to those assessed for the East Route;

- **Indigenous Engagement:** a discussion of Trans Mountain's Indigenous engagement efforts and outcomes;

- **Lands, Utilities and Related Engagement:** a description of the lands, tenures and utilities crossed by the West Alternative, including a summary of Trans Mountain's engagement efforts and outcomes with related non-Indigenous stakeholders;

- **Justification for Proposed Variance:** Trans Mountain's rationale and justification for pursuing the Variance Application, including a summary of comparisons as between the West Alternative and the East Route and an explanation as to why Trans Mountain considers the West Alternative to be superior to the East Route; and

- **Relief Sought:** a description of the relief sought in this Variance Application, including Trans Mountain's assessment of condition compliance requirements associated with the proposed variance.

III. BACKGROUND

3. On December 16, 2013, Trans Mountain filed an application with the National Energy Board ("NEB" or "Board") (the predecessor of the CER) to construct and operate the Project. Following an extensive and detailed regulatory process before the NEB, and considering the benefits and impacts of the TMEP and Canada's duty to consult with Indigenous peoples, the Governor in Council ("GIC") approved the Project, including the Project corridor along the East Route ("Corridor"), on November 29, 2016.

4. Following the August 30, 2018 decision of the Federal Court of Appeal ("FCA") in *Tsleil-Waututh Nation v. Canada (Attorney General)*, 2018 FCA 153, the Project was subject to a further regulatory process before the Board and Crown consultation by the federal government. On June 18, 2019, the GIC re-approved the Project, including the Corridor, and the Board issued Certificate OC-065. Condition 39 of Certificate OC-065 ("Condition 39") required Trans Mountain to complete a hydrogeological study regarding the aquifer at the Reserve.

5. In addition, as part of the re-initiated Phase III Crown consultation process with Coldwater conducted in 2019, Trans Mountain adopted a series of commitments ("Coldwater Commitments")[1] to further explore a western alignment for the TMEP through the Coldwater Valley. Specifically, Trans Mountain committed to conduct a feasibility study of the West Alternative and to engage with Coldwater on routing matters for a period of three months after completing the feasibility study and the report required by Condition 39 prior to seeking approval of a route through the Coldwater Valley (either through a detailed route hearing or a Variance Application).

6. On April 15, 2020 and in furtherance of its obligations under the Coldwater Commitments, Trans Mountain filed a report titled *Feasibility Study of the Coldwater IR West Alternative Route* (A7E8W7) ("Feasibility Study"). The Feasibility Study concluded that the West Alternative is a technically feasible route alternative for the TMEP.

7. On May 15, 2020, Trans Mountain filed a report titled *CER Condition 39 and EAO Condition 25 Hydrogeological Study* ("Condition 39 Report") regarding Trans Mountain's hydrogeological study at the Reserve.[2] The Condition 39 Report concluded that routing the TMEP along the East Route posed a low, but non-zero, risk to the aquifer underlying the Reserve.[3] The Condition 39 Report further noted that the risk posed to Coldwater's

---

[1] The Coldwater Commitments include Commitments #4,165 through #4,167 of Part B of Trans Mountain's Commitment Tracking Table.

[2] Condition 39 Report, including Appendices A-E (C06341).The Condition 39 Report is filed in satisfaction of CER Condition 39 and British Columbia Environmental Assessment Office ("EAO") Condition 25. The Condition 39 Report includes a comprehensive quantitative assessment of the risk of a potential pipeline release within the approved Project corridor to Coldwater's main water supply, which is sourced from an aquifer underlying the Reserve.

[3] The Condition 39 Report found that, through the implementation of mitigation measures, the quantitative risk of causing an exceedance of water quality guidelines at any given water well on the Reserve posed by the TMEP along the East Route was equivalent to less than once every 11,800 years.

community water supply wells on the Reserve from a West Alternative would be even less than the low risk estimated for the East Route.

8. Since the filing of the Feasibility Study and Condition 39 Report, and to address Coldwater's requests to avoid potential impacts to the Reserve and underlying aquifer, Trans Mountain has continued to assess and discuss the West Alternative with Coldwater, other Indigenous groups and local stakeholders. On July 29, 2020, Trans Mountain filed a Project Notification in relation to this Variance Application, wherein Trans Mountain notified the Commission and other regulators and stakeholders that it was considering a potential application to the CER for approval of the West Alternative route (A7H4S2). Coldwater confirmed that the West Alternative addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Community and, after further evaluating the West Alternative and engaging with Indigenous groups and other stakeholders, Trans Mountain decided to proceed with this Variance Application in response to Coldwater's requests. Subject to further engagement with the Community, Coldwater's Chief and Council have confirmed their support for the proposed West Alternative and this Variance Application.

IV. DESCRIPTION OF PROPOSED WEST ALTERNATIVE ROUTE AND DESIGN

9. The corridor and pipeline route for the West Alternative are shown in Error! Reference source not found. below, which also shows the East Route for reference. The West Alternative deviates from the East Route at kilometre post (”KP”) 931.43 and joins the East Route at KP 946.88. The West Alternative is located on Crown land for 14.45 km and privately owned land for 3.91 km in Thompson-Nicola Regional District, BC, near Merritt, BC, for a total length of 18.36 km. Approximately 14.3 km of the Reroute is parallel to other linear features (*e.g.,* Enbridge (Spectra) right-of-way, TELUS Fibre-Optic Transmission System) (Jacobs 2020b; Kinder Morgan 2012) and the remaining 4 km of the Reroute is greenfield (*i.e.*, not adjacent or parallel to any existing utility or road feature). Trans Mountain will utilize existing access roads and trails to the extent possible to support construction and operation of the TMEP along the Reroute. Some roads may require upgrading prior to construction to ensure roads are safe for crew and equipment travel but will be decommissioned after construction with the exception of permanent access roads that will be required for ongoing access to the valve sites.

10. This section of the East Route is 15.45 km long, and the West Alternative measures 18.36 km, an additional 2.91 km. As the West Alternative deviates west from the East Route, it crosses the Coldwater River (“West Alternative Coldwater River Crossing #1a”), before heading up the western valley slope, eventually crossing Midday Valley Road. This part of the West Alternative is greenfield and does not parallel existing roads or utilities for approximately 4.5 km. The initial greenfield portion of the West Alternative ends at Midday Valley Road. At approximately West Alternative Kilometre Post (“AK”) 5.02, the West Alternative begins to run parallel with a TELUS Fibre Optics Transmission System (“FOTS”) buried cable. At approximately AK 8.4, the West Alternative turns south and aligns with two Enbridge (Spectra) pipelines and continues south, paralleling either the Enbridge pipelines or the Telus FOTS cable as it crosses the Coldwater River at the south

end of the Reroute ("West Alternative Coldwater River Crossing #2") and re-joins the East Route at KP 946.88.[4]

11. The following is a summary of the main features of the West Alternative relevant to construction, engineering design, and the pipeline risk assessment:

    - approximately 4 km of greenfield construction (not parallel to any existing utility or road feature);

    - approximately 14.3 km of construction parallel to other linear features, including the existing Enbridge (Spectra) right-of-way and the existing TELUS FOTS right-of-way;

    - one (1) crossing of the existing Enbridge (Spectra) right-of-way, which may involve a total of two (2) pipeline crossings (as there are two buried pipelines in the Enbridge (Spectra) right-of-way), according to field survey data;

    - two (2) trenchless crossings of the Coldwater River – West Alternative Coldwater River Crossing #1a (the northernmost crossing, discussed further below) and West Alternative Coldwater River Crossing #2 (the southernmost crossing); and

    - avoidance of a slope geohazard along the west valley slope, on the west side of the Coldwater River (see Figure 1 above).

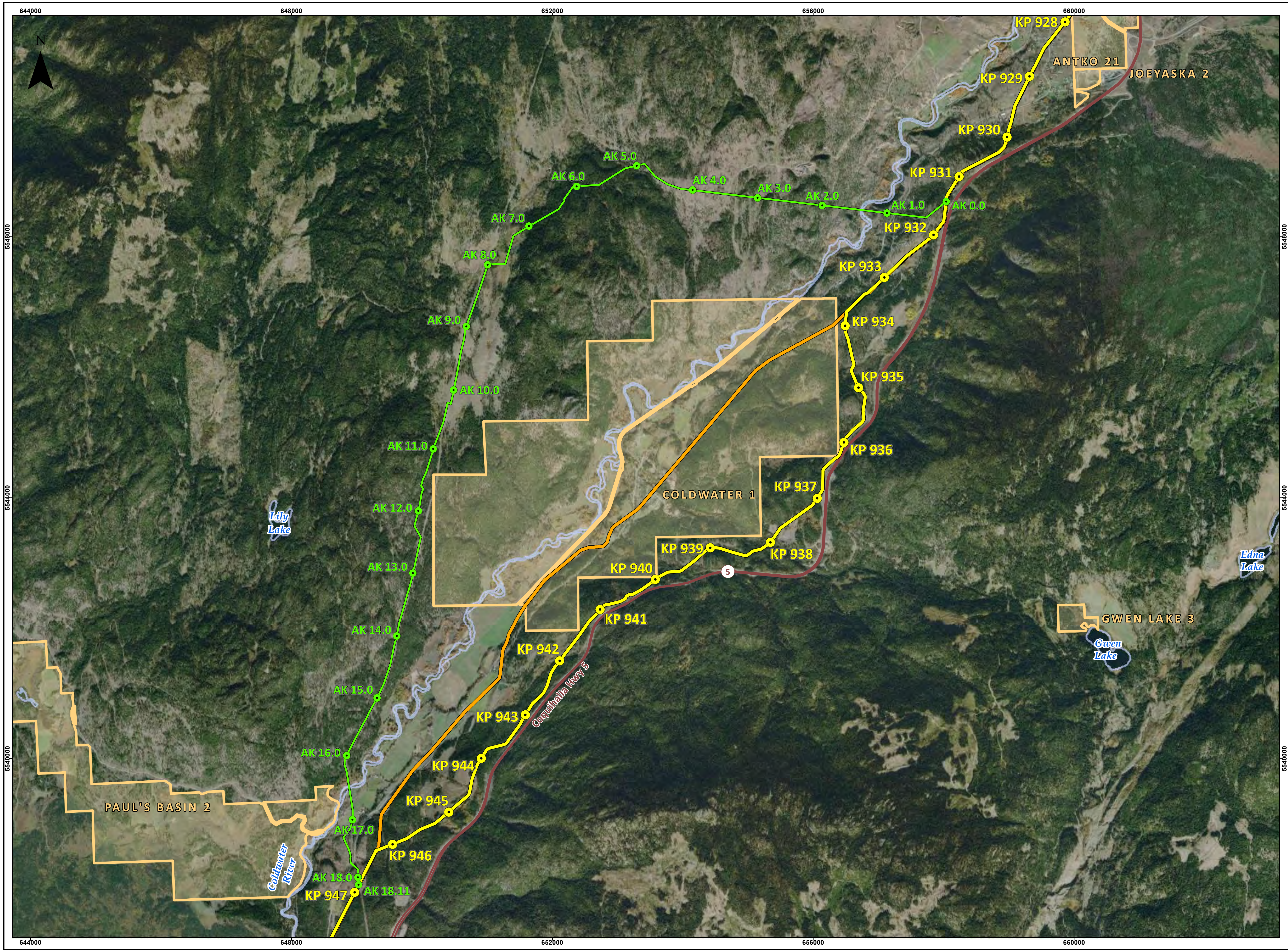
12. Initially, Trans Mountain contemplated crossing the Coldwater River at the northernmost crossing location via horizontal directional drill ("HDD"), which was discussed in the Feasibility Study and identified as West Alternative Coldwater River Crossing #1. As noted in the Feasibility Study, further geotechnical assessment was required to assess the feasibility of this crossing method and location. Subsequent assessment of additional borehole logs and geotechnical conditions confirmed that the contemplated HDD drill, which was approximately 1500 m in length, was technically challenging.[5] Trans Mountain subsequently identified an alternate crossing location and method, identified herein as West Alternative Coldwater River Crossing #1a, which is considered to present fewer technical challenges relative to the HDD crossing. The West Alternative Coldwater River Crossing #1a is discussed further below.

13. The design criteria for the pipeline within the proposed West Alternative are based on the fundamental engineering philosophies, principles and design objectives for the TMEP. **Appendix A-1** to this Variance Application includes the West Alternative footprint drawings, which provide engineering details for the proposed West Alternative route and associated temporary infrastructure sites.

---

[4] See Figure 4 in the Feasibility Study.

[5] Risks specific to the HDD installation included high artesian groundwater pressures observed in borehole BH-BGC20-CW6-02. Artesian pressures may result in flowing sands and borehole collapse in addition to surface release of water during HDD drilling. Geophysical surveys indicated artesian conditions may be present elsewhere along the HDD borepath, including near the HDD invert. Zones of drill fluid loss and poor circulation were expected in the fluvial sand and gravel unit, and the presence of large clasts created the potential for borepath instability, steering challenges, possible jamming of reamers and possible damage to the product line during pull through.



TRANS MOUNTAIN

COLDWATER REROUTE AR3359

PROPOSED TRANS MOUNTAIN PIPELINE ULC

- ● Coldwater Alternative Kilometre Post (KP)
- ● TMEP Pipeline Kilometre Post (KP)
- — Coldwater West Alternative Pipeline Route
- — TMEP Pipeline
- — Existing TMPL Pipeline
- ① Highway
- ▭ Indian Reserve
- ▭ Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (AR3359) provided by UPI May 22, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI November 17, 2018; TMPL Route Revision 0 provided by KMC, May 2012; Transportation: BC MFLNRO 2012; Hydrology: BC MFLNRO 2008; First Nation Lands: Government of Canada 2018; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202001_MAP_CH2M_GEN_01168_REV2

DATE June 2020	REFERENCE CE733700	REVISION 1
SCALE 1:55,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SMZ	CHECKED DJN	DESIGN CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202001_MAP_CH2M_GEN_01168_Rev2.mxd

14. Key design features of the pipeline and construction footprint along the West Alternative are as follows:

    (a) The permanent easement will be 25 m in width and the construction footprint will be approximately 45 m wide, with extra temporary workspace areas for bends and crossings.

    (b) Apart from the trenchless sections at the Coldwater River crossings, geohazard areas and other site-specific designs, depth of cover over the pipeline will be approximately 0.9 to 1.2 m.

    (c) Based on current information, Trans Mountain believes there is sufficient existing access to all areas of the West Alternative, although some trails will require upgrading for pipe trucks, lowbed trucks hauling heavy equipment, and other construction vehicles. Main road access includes Highway 5, the asphalt Coldwater Road, the Kettle Valley Trail, the Midday Valley Road, Paul Basin Road and numerous gravel and dirt trails that parallel the Enbridge (Spectra) right-of-way. Trans Mountain will utilize existing access roads and trails to the extent possible.

    (d) Based on satellite imagery from November 2019 and the field surveys conducted by Trans Mountain and its consultants, the number of crossings on the West Alternative is understood to include: 7 named roads; a number of trails, 3 pipelines (all of which are third-party pipelines); 5 crossings of the Telus FOTS cable; 4 overhead powerline crossings; 4 wetland crossings; 2 crossings of the Coldwater River; and 26 other watercourses. Crossing designs will incorporate all applicable regulatory requirements including conditions specified by each permit or agreement, as applicable. These crossings will be updated and confirmed prior to construction.

    (e) Both crossings of the Coldwater River will be constructed by trenchless methods. The Coldwater River has a narrow Least Risk Biological Window for in-stream work due to the number and type of fish species present in the watercourse, supporting the decision for trenchless construction methods.

    (f) The West Alternative Coldwater River Crossing #1a will be constructed by Direct Pipe® Installation ("DPI") methods at the location shown in Figure 1. This crossing will be approximately 300 m in length, starting at AK 1.3 and ending at AK 1.6 DPI is a trenchless method suitable for crossings up to 500 m in length in a variety of subsurface conditions. Geotechnical investigations are underway to confirm subsurface conditions, and a complete feasibility assessment will be prepared and submitted pursuant to *Condition 67: Outstanding horizontal directional drilling geotechnical and feasibility reports*. In the event that the DPI at this crossing location cannot be executed for a technical reason, Trans Mountain will complete the crossing by another trenchless method – Micro-Tunnel – at the same location.

        Both the DPI and the Micro-Tunnel methods utilize a slurry micro-tunneling unit to complete the excavation. The excavation equipment is capable of operating above and below the groundwater table in a wide range of geological formations while maintaining an accurate line and grade (+/- 10 cm). Micro-tunneling and DPI are commonly utilized to complete crossings in complex, confined environments and demonstrate a strong performance record on dozens of crossings in western Canada over the past 10 years. These highly sophisticated construction equipment units are operated by specialty contractors, ensuring that expert operators and experienced crews will be executing the crossing. Trans Mountain has a high degree of confidence in its ability to successfully implement the proposed and contingency crossing methods for West Alternative Coldwater River Crossing #1a.

(g) West Alternative Coldwater River Crossing # 2 will be constructed by HDD at the location shown in Figure 1. Crossing #2 will be approximately 530 m in length, starting at approximately AK 16.5 and ending at approximately AK 17.09. A geotechnical feasibility assessment for this crossing was completed, based on a desktop review of the relevant regional and local geological settings, a field investigation component including the drilling of four geotechnical boreholes and completion of geophysical surveys, a hydrotechnical assessment and the compilation and interpretation of these data to provide, from a geotechnical perspective, an indication of the feasibility of the proposed HDD. A geotechnical assessment of the HDD crossing is included as **Appendix A-2**. An HDD Feasibility Report for this crossing will prepared and submitted pursuant to *Condition 67: Outstanding horizontal directional drilling geotechnical and feasibility reports*. Preliminary results conclude that an HDD crossing at the Coldwater River Crossing #2 location can be considered feasible from a geotechnical perspective. The assessment further identifies the potential need for flood protection measures, which Trans Mountain is currently evaluating and will address during detailed design and construction execution planning, should this Variance Application be approved. In the event that the HDD cannot be completed for technical or other reasons, the contingency crossing method at this location will be DPI.

(h) A valve will be installed at either side of each of the two proposed Coldwater River crossings, for a total of four valves along the West Alternative (see Figure 1 above). These will be two mainline block valves and two check valves. The precise valve locations and configurations will be finalized based on a release volume analysis during detailed design. This final design will inform an update of Condition 17: Valve Locations on Line 2.

(i) The basis of engineering design will be CSA Z662-19. Pipe specifications will be confirmed during detailed design work. At this time, it is anticipated that the Project will use NPS 36 grade 483 pipe of 19.0 mm (for DPI and HDD) and 14.7 mm wall thickness for major crossings and cross country.

(j) Trans Mountain's consultant, Dynamic Risk, is preparing a pipeline operations quantitative risk assessment that includes the West Alternative. Based on current time estimates provided by Dynamic Risk, Trans Mountain anticipates filing this information with the CER by November 30, 2020. This report will include an update to Condition 15: Pipeline Risk Assessment (see Appendix D).

15. To meet the current December 2022 in-service date for the TMEP, construction mobilization and clearing will need to commence in the Coldwater Valley by no later than August 2021. As discussed, the West Alternative includes two trenchless crossings of the

Coldwater River, one by DPI and one by HDD. These crossings require significant lead time and are subject to execution risks, which can prolong execution timelines.

V. ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

16. Trans Mountain's environmental consultant, Jacobs Canada Inc. ("Jacobs"), conducted an ESA of the West Alternative and determined whether the impacts associated with the West Alternative change the conclusions of the ESA previously conducted for the Project. The West Alternative ESA is attached as **Appendix B** to this Variance Application.

17. The environmental and socio-economic issues and concerns along the West Alternative are consistent with those associated with the construction and operation of the Project along the East Route. These were identified and assessed in the original ESA and related filings, including Volumes 5A and 5B of the Facilities Application (A56004), ESA Update (A4F4Z3) and responses to NEB Information Request ("IR") No. 2.041 (A3Z4T9) and IR No. 3.025 (A4H1V2). The assessment team – comprised of independent and qualified technical professionals – reviewed the setting (current state of the environment) for each of the biophysical and socio-economic elements to evaluate whether the West Alternative could have any new or unique interactions that would change the indicators, potential or residual effects, cumulative effects or significance conclusions of the original ESA and related filings. The review and assessment considered not only the information collected during the original ESA and related filings but also the information collected since. This included new critical habitat information, new consultation feedback, the NEB Recommendation Report (A77045), the Reconsideration Hearing (MH-052-2018) and Phase III Consultation (Government of Canada 2019). The assessment considered whether any of the new information affected the conclusions of the original ESA and related filings, which was previously approved and meets the requirements of the Filing Manual Guide A (CER 2020).

18. The CER Interim Guidance and Early Engagement Guide was reviewed and considered in the context of this ESA. Early engagement can help to identify and address issues, foster discussions and assist in the review process. Trans Mountain's Indigenous and stakeholder engagement specific to the West Alternative is discussed below. In consideration of the level of consultation and engagement conducted to date, including the recent Phase III and Phase IV consultation, specific engagement on the West Alternative and the existing Project-specific Condition Plans, no new or additional potential interactions or effects specific to the new factors in the legislation (*e.g.*, gender-based analysis plus [GBA+], effects on Indigenous rights, greenhouse gas (GHG) emissions and climate change and climate change commitments and environmental obligations) are anticipated to occur as a result of construction or operation of the West Alternative.

19. The West Alternative encounters four new environmental features that were not encountered by the East Route; however, these types of features are encountered elsewhere by the Project and are considered to be included in the original respective element-specific assessment for the TMEP, as discussed below.

20. First, the Reroute encounters lands considered to have a medium risk for natural hazard potential. Terrain stability and natural hazard (*e.g.,* rock fall, debris flow, debris floods, floods, channel changes, rock avalanches) mapping completed for the Reroute identified glaciofluvial, fluvial, till, colluvial, glaciolacustrine, anthropogenic and organic surface materials and bedrock. Natural hazards at elevated risk included the crossings of the

Coldwater River as well as an area of potential landslide instability on the west side of the river (BGC 2020). This risk can be mitigated through use of route refinements and trenchless construction to avoid or pass below these hazards.

21. Second, the West Alternative crosses the Coldwater River in two locations. Trans Mountain is proposing two trenchless crossings of the Coldwater River. The first crossing (Crossing #1a) will use DPI with a contingency of micro-tunnelling if DPI proves infeasible. The second crossing (Crossing #2) will be by HDD, with a contingency method of DPI. Both crossings avoid disturbance to the Coldwater River, and therefore effects on water quality and quantity and fish and fish habitat will be avoided.

22. Third, the West Alternative crosses several Wildlife Habitat Areas (WHA) for Williamson's sapsucker that were not previously crossed by the Project. Most of the length of these WHAs overlaps with critical habitat for Williamson's sapsucker as identified by ECCC. The mitigation and habitat restoration measures that will be implemented within areas of critical habitat for Williamson's sapsucker (per the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan [A6C7I3]) will also be implemented within the WHAs, in both cases where the biophysical attributes of critical habitat are present. This is consistent with the approach for areas of critical habitat crossed by the original alignment. Similarly, if critical habitat mapping for western screech-owl is received from ECCC and overlaps with the Reroute, mitigation and habitat restoration measures will be implemented per the Western Screech-owl Mitigation and Habitat Restoration Plan (A6C7J8). Field studies to identify site-specific locations of biophysical attributes (*e.g.*, suitable nest trees and colonies of aphid tending ants) and species-specific surveys for Williamson's sapsucker were completed along the West Alternative during the appropriate survey period in June 2020 to inform mitigation.

23. Fourth, the Reroute centreline is approximately 77 m from a water supply well. The Groundwater Management Plan in the EPP outlines measures to protect and monitor groundwater during construction. Water well (Tag #115219) is licensed under the BC *Water Sustainability Act* to divert groundwater for livestock watering use.

24. BC Conservation Data Centre ("CDC") occurrences of Red- and Blue-listed plants, lichens and ecological communities within 1 km of the Reroute were reviewed and no BC CDC records were identified. No Committee on the Status of Endangered Wildlife in Canada (COSEWIC)- or *Species at Risk Act* (*SARA)*-listed species were observed along the West Alternative during the vegetation surveys. No critical habitat for vegetation species at risk is present within the West Alternative corridor.

25. The West Alternative was assessed as having high archaeological potential during desktop review and an archaeological impact assessment ("AIA") was recommended. Upon completion of the AIA, a report will be produced detailing results of the study and will provide management recommendations for all identified archaeological sites. The AIA report will be provided to the Archaeology Branch of the BC Ministry of Forests, Lands, Natural Resource Operations & Rural Development (MFLNRORD) and applicable Indigenous groups.

26. The assessment team reviewed the West Alternative and determined that it will not change the effects assessment criteria or significance conclusions of the original ESA and related filings. The assessment concludes that with the appropriate mitigation, the predicted Project-related effects, and cumulative effects of the proposed variance are not

significant for any terrestrial biophysical or socio-economic indicator. There are no new or unique interactions with the environmental and socio-economic elements identified as a result of the proposed variance. Updates to applicable construction-related documents (*e.g.*, Environmental Alignment Sheets ("EAS") and Resource-Specific Mitigation Tables ("RSMT")) will be completed prior to construction to include the specific mitigation and monitoring measures relevant to the West Alternative.

27. To support and inform the field studies, participants from the Scw'exmx Tribal Council (Nooaitch Indian Band, Shackan Indian Band), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry Indian Band, Coldwater, Siska First Nation) accompanied the wetlands, wildlife and vegetation field crews to identify environmental, cultural and social resources along the West Alternative. In addition, draft technical data reports were issued to N'laka'paumx Nation Tribal Council ("NNTC") and Coldwater representatives for technical review, at their request. Letters of comment regarding the draft documents were provided by the NNTC and Coldwater. Trans Mountain reviewed and considered these comments in coordination with its consultants and provided responses to the reviewers, confirming that in the majority of cases, Trans Mountain was able to accommodate comments received.

28. Coldwater has indicated there are sacred sites including ancestral places (burials), ceremonial areas, sweat lodges, ritual bathing sites, vision quest locations, sun dance grounds, sacred waterfalls, mountains, archaeological pit house sites, locations inhabited by spirit beings, including the 'little people' as well as special avoidance areas that may be present on the West Alternative. To date, Coldwater has identified nine TLU sites along the West Alternative, including hunting and fishing sites, two sacred sites and one cultural site. Trans Mountain will work with Coldwater to review and update the confidential RSMTs and EASs to reflect this information (much of which is confidential) prior to construction.

29. As further discussed in the ESA, supplemental environmental studies will be conducted, as required, in spring/summer of 2021 prior to construction. Results from these studies will be included in the RSMTs and EAS.

VI. INDIGENOUS ENGAGEMENT

A. Approach

30. Trans Mountain respects the unique constitutional rights of Indigenous Peoples and is committed to open and transparent engagement throughout the life of the Project. Trans Mountain seeks to build lasting and mutually beneficial relationships through ongoing communication; tailored to respect the diverse needs of the community.

31. Trans Mountain's Indigenous Engagement Program was designed to create an open, transparent and inclusive process that seeks to:

- exchange information in a respectful manner;
- address concerns shared by those who might have an interest in the Project or have Indigenous interests potentially affected by the Project;
- incorporate feedback into Project planning and execution; and

- provide Project benefits.

32. The Trans Mountain Indigenous Engagement Program is guided by the Indigenous Relations Policy and the following principles:

- Build trust and respect – These values form the basis of Trans Mountain's engagement with Indigenous People.
- Conduct meaningful engagement – Ensure the engagement process is comprehensive and respects the interests of Indigenous People.
- Address legal requirements – Carry out Trans Mountain's legal requirements as a regulated company under CER jurisdiction to engage with and mitigate, where necessary, where there are any Project impacts on the assertion of Indigenous rights and title governing traditional and cultural use of the land and marine environment.
- Gather Indigenous perspectives – Build understanding regarding Indigenous rights and asserted rights, and identify issues and concerns relating to those rights and the Project.
- Assess Project impacts – Share information, identify and assess potential impacts, develop measures to avoid, manage or mitigate where necessary.
- Reach understanding – Seek understanding or agreement to address potential infringement of Indigenous rights affected by the Project.
- Provide benefits – Explore economic participation opportunities such as employment and workforce development, procurement and contracting, and the potential to consider various forms of commercial agreements.

33. Trans Mountain is committed to continued listening, learning and working with Indigenous People to ensure that knowledge and advice is fully considered and incorporated in the Project.

B. Summary of Engagement Efforts and Outcomes

34. Trans Mountain has a long and extensive engagement history with Coldwater on the issue of routing through the Coldwater Valley. Appendix D to the Feasibility Study provides a summary of Trans Mountain's consultation with Coldwater on this issue through to the time of its filing on April 15, 2020. That summary was supported by a log of verbatim communications and meeting summaries, included as Appendix E to the Feasibility Study. Since May of this year, Trans Mountain President and CEO, Ian Anderson, has been meeting regularly with Chief Lee Spahan of Coldwater, attempting to reach consensus on routing. In early October, Coldwater confirmed that the West Alternative route for the TMEP addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Community. Subject to further engagement with the Coldwater Community, Chief Spahan and Council have confirmed their support for the proposed West Alternative and this Variance Application.

35. In addition to its engagement with Coldwater, Trans Mountain has engaged with other potentially affected Indigenous groups regarding the West Alternative. Section 9.0 of the Feasibility Study describes these early engagement efforts and includes the full list of Indigenous groups with traditional territories that overlap or may overlap with the West Alternative, and with which Trans Mountain has engaged regarding the West Alternative.

36. Since filing the Feasibility Study, Trans Mountain has continued to engage with potentially affected Indigenous groups, including by providing the following written correspondence to all groups:

- April 23, 2020: Trans Mountain confirmed that the Feasibility Study had been filed with the Commission and provided a link to the filing.

- April 28, 2020: Trans Mountain shared information regarding its upcoming geotechnical drilling work to support its review of the West Alternative, including two boreholes near the potential northern Coldwater River crossing. Trans Mountain invited Indigenous groups to send a representative to monitor the work.

- May 6 and 10, 2020: Trans Mountain informed Indigenous groups of an upcoming biophysical field study along the West Alternative scheduled for June 2020. Trans Mountain confirmed the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies, and invited Indigenous groups to provide a representative to participate (as a subcontractor).

- May 19, 2020: Trans Mountain provided a description of the upcoming biophysical fieldwork occurring June 8 - July 3, 2020 and reiterated its invitation for Indigenous groups to provide a representative to participate (as a subcontractor).

- May 28, 2020: Trans Mountain wrote to Indigenous groups seeking to understand their respective positions on the West Alternative. Trans Mountain provided a description of the West Alternative and the related background, including the filed Feasibility Study. Trans Mountain invited comments from Indigenous groups on the West Alternative and the associated Feasibility Study and offered to provide a presentation on the West Alternative and answer any questions. It further advised that Trans Mountain's routing determination would be made in the summer of 2020 and requested comments by June 15, 2020.

- June 2, 2020: Trans Mountain invited Indigenous groups to participate in field studies related to fish and fish habitat assessments along the West Alternative, which studies were scheduled to take place in early July 2020. Trans Mountain confirmed that the fieldwork would take three days.

- August 6, 2020: Trans Mountain emailed a status update of engagement pertaining to the West Alternative. Trans Mountain invited comments and feedback on the West Alternative, provided notice of and opportunities to participate in fieldwork related to the West Alternative, as well as offered to meet to discuss the West Alternative and any related issues. A map of the proposed route was attached as well as a letter template to canvas support for Coldwater's position on the West Alternative, requesting a formal response to be provided by August 15, 2020. Communication stated that Trans Mountain is planning to file an application for the CER consideration for the West Alternative no later than September 1, 2020. Communication indicated that members of the Trans Mountain engagement team would be following up to seek a response and that Coldwater would welcome any questions.

- August 7, 2020: Trans Mountain wrote to Indigenous groups to inform them that it filed a project notification letter with the CER on July 29, 2020 regarding the West

Alternative, a link to and copy of which was attached. Trans Mountain stated that the West Alternative would require a change in the approved Project corridor and invited groups to contact their respective Trans Mountain advisor with any questions or requests for clarification they may have.

- August 7, 2020: Trans Mountain wrote to Indigenous groups to inform them that while Trans Mountain and Coldwater were working towards consensus on the preferred route through the Coldwater Valley, the approved eastern route remains a viable option available for Trans Mountain to preserve the declared in-service date for its customers. Trans Mountain asked Indigenous groups to response if they had further questions or wished further clarification.
- September 9, 2020: Trans Mountain wrote to Indigenous groups to inform them that Trans Mountain was evaluating alternative trenchless methods to HDD for the northern Coldwater River crossing in light of additional geotechnical drilling results. Trans Mountain described the alternatives of DPI and Micro-Tunnelling and asked Indigenous groups to contact Trans Mountain if they had questions or wanted further clarification.
- September 11, 2020: Trans Mountain followed up on the September 9 engagement to ensure the engaged Indigenous groups had received the email.
- September 16, 2020: Trans Mountain through its consultants, wrote to inform all Indigenous groups of the opportunity to participate in an upcoming one-day visit assessment of the proposed DPI crossing (Coldwater Crossing #1a) under the Coldwater River and accompanying proposed temporary workspace and drag section. It was stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Trans Mountain requested expressions of interest to participate by September 30, 2020.

37. An engagement log summarizing communications to and from each Indigenous group potentially affected by the West Alternative is enclosed as **Appendix C-1** to this Variance Application. The responses received from each of the Indigenous groups in relation to the West Alternative are summarized in Table 1 below. The letters of support referenced in Table 1 are provided in **Appendix C-2**.

Table 1: Summary of Responses from Indigenous Groups to Date

Indigenous Group	**Feedback on West Alternative**
Ashcroft Indian Band	Has provided documented support for the TMEP previously. No response to West Alternative engagement attempts and no indication of concerns.
Boston Bar First Nation	Has indicated that it will support an application for the West Alternative if Coldwater supports it, including a formal support letter for Coldwater's position on the West Alternative. Has not expressed any concerns with the West Alternative.

Coldwater Indian Band	Has confirmed that the West Alternative addresses its concerns regarding potential impacts to the aquifer used by the Coldwater Community. Subject to further engagement with the Coldwater Community, Coldwater Chief and Council have confirmed their support for the proposed West Alternative and this Variance Application. Coldwater provided a letter confirming this position on October 9, 2020.
Cook's Ferry Indian Band	Has expressed interest in the environmental fieldwork regarding the West Alternative and has submitted a letter of unconditional support for Coldwater's position on the West Alternative.
Kanaka Bar First Nation	Has stated it will defer to Coldwater with respect to the West Alternative, as Coldwater is the most proximal community to the route. Has not expressed any concerns with the West Alternative.
Lower Nicola Indian Band	Has provided support for the TMEP previously. Has engaged with Trans Mountain regarding environmental field work and studies for the West Alternative, has expressed general concerns regarding short- and long-term impacts, and has declined to take a position on the West Alternative thus far. Has not expressed any specific concerns with or opposition to the West Alternative.
Lower Similkameen Indian Band	No response to West Alternative engagement attempts and no indication of concerns.
Nicomen Band	Has provided support for the TMEP previously. Has expressed interest in the West Alternative and related fieldwork but has not identified any concerns with the West Alternative.
N'laka'paumx Nation Tribal Council ("NNTC") • Boothroyd Indian Band (NNTC) • Lytton First Nation (NNTC) • Oregan Jack Creek Indian Band (NNTC) • Skuppah Indian Band (NNTC)	Has requested to review environmental studies regarding the West Alternative and has raised concerns about the potential to impact archeological resources. Trans Mountain provided drafts of the ESA to NNTC to review and has incorporated NNTC's comments into the final version (except as noted and discussed with NNTC previously). Trans Mountain has also engaged with NNTC on archaeological impact assessment (AIA) work related to the West Alternative and has provided funding to NNTC to conduct archaeological field work (beyond AIA work conducted by Trans Mountain's archaeological consultant) to facilitate NNTC input and maximize avoidance or minimize impacts on archaeological resources. NNTC has not expressed any specific concerns with or opposition to the West Alternative.
Nooaitch Indian Band	Has provided support for the TMEP previously. Has expressed interest in biophysical fieldwork for the West Alternative and has worked with Trans Mountain to

	address concerns regarding potential impacts to sites of cultural value near geotechnical assessment areas. Has stated it will support Coldwater's decision on the West Alternative and that it wants to ensure Coldwater's involvement prior to any work being conducted. Has provided a formal support letter for Coldwater's position on the West Alternative.
Okanagan Indian Band (Okanagan Nation Alliance ("ONA"))	No response to Western Alternative engagement attempts or indication of concerns.
Penticton Indian Band (ONA)	No response to West Alternative engagement attempts or indication of concerns.
Shackan Indian Band	Has provided support for the TMEP previously. Has expressed interest in biophysical fieldwork for the West Alternative and has worked with Trans Mountain to address concerns regarding impacts to sites of cultural value near geotechnical assessment areas. Has stated it will support Coldwater's position on the West Alternative and that it wants to ensure Coldwater's involvement prior to any work being conducted. Has provided a formal support letter for Coldwater's position on the West Alternative.
Siska First Nation	Has confirmed that it supports Coldwater's position and that it will support an application for the West Alternative if Coldwater supports it, including a formal support letter for Coldwater's position on the West Alternative. Has not expressed any concerns with the West Alternative.
Spuzzum First Nation (previously a member of NNTC)	Has confirmed that it supports Coldwater's position and that it will support an application for the West Alternative if Coldwater supports it. Has also provided in a formal support letter for Coldwater's position on the West Alternative. Has not expressed any concerns with the West Alternative.
Upper Nicola Band (ONA)	Has provided support for the TMEP previously. Has confirmed that it supports Coldwater's position and that it will support an application for the West Alternative if Coldwater supports it.
Upper Similkameen Indian Band (ONA)	Has stated that the West Alternative is outside its area of interest and responsibility and therefore has no issues or concerns with it.

VII. LANDS, UTILITIES AND RELATED STAKEHOLDER ENGAGEMENT

A. Lands

38. Lands affected by the West Alternative are primarily Crown land. Specifically, about 80% or 14.45 km of the West Alternative is on Crown land (19 parcels), and 21% or 3.91 km is on private land (8 parcels).

39. The private land affected is largely at the north end of the route between AK 0.5 and AK 2.5, where the West Alternative crosses four large residential properties and two agricultural properties. The alignment also traverses two agricultural properties at the southern end of the route between AK 14.8 and AK 18.2.

40. Most of the Crown lands are occupied by grazing tenures, which consist of the following six tenures:

- RAN077654
- RAN077659
- RAN077658
- RAN076725
- RAN077470
- RAN077102

B. Utilities

41. The details of the utilities, trails and roadways that will be crossed by the Project along the West Alternative are summarized in Table 2 below. The crossing list will be updated and confirmed prior to construction.

Table 2: Summary of Utility Crossings on the West Alternative Route

AK	PXID	Owner	Description
0.782	T6142.0	PRIVATE LANDOWNER	PRIVATE ROAD
0.846	T6164.0	PRIVATE LANDOWNER	TRAIL
0.848	U7078.0	BC HYDRO	BC HYDRO O/H DISTRIBUTION
0.848	U7079.0	TELUS	TELUS O/H COMMUNICATIONS CABLE
0.865	U7076.0	BC HYDRO	BC HYDRO O/H DISTRIBUTION
0.865	U7077.0	TELUS	TELUS O/H COMMUNICATIONS CABLE
0.877	U7080.0	TELUS	TELUS BURIED CABLE
0.882	T6143.0	MINISTRY OF TRANSPORTATION & INFRASTRUCTURE	COLDWATER RD
0.887	P5808.0	FORTIS BC	FORTIC BC BURIED PIPE
0.957	T6144.0	PRIVATE LANDOWNER	PRIVATE ROAD
1.049	T6165.0	PRIVATE LANDOWNER	TRAIL
1.116	T6166.0	PRIVATE LANDOWNER	TRAIL
1.189	T6145.0	PRIVATE LANDOWNER	PRIVATE ROAD

Table 2: Summary of Utility Crossings on the West Alternative Route

AK	PXID	Owner	Description
1.274	T6146.0	PRIVATE LANDOWNER	PRIVATE ROAD
1.503	T6147.0	BC CROWN	NICOLA KAMLOOPS AND SIMILKAMEEN RAIL TRAIL
1.566	T6148.0	PRIVATE LANDOWNER	ROAD
1.964	T6149.0	PRIVATE LANDOWNER	ROAD
2.929	T6151.0	SHULUS FOREST ENTERPRISES INCORPORATED	FSR R18498 COUT-07-0 - ACTIVE
3.506	T6152.0	BC CROWN	RECREATIONAL TRAIL
3.509	T6153.0	BC CROWN	ROAD
3.638	T6154.0	BC CROWN	ROAD
3.681	T6155.0	MINISTRY OF TRANSPORTATION & INFRASTRUCTURE	MIDDAY VALLEY RD
4.394	T6167.0	BC CROWN	ROAD
4.786	U7081.0	TELUS	TELUS U/G FIBRE OPTIC COMMUNICATIONS CABLE
5.237	T6113.0	MINISTRY OF TRANSPORTATION & INFRASTRUCTURE	MIDDAY VALLEY ROAD
5.359	T6114.0	PRIVATE LANDOWNER	LOGGING TRAIL - 3m
5.383	T6115.0	PRIVATE LANDOWNER	LOGGING TRAIL - 3m
6.022	T6125.0	BC CROWN	LOGGING TRAIL - 3m
6.108	T6126.0	BC CROWN	LOGGING TRAIL - 3m
6.194	T6128.0	BC CROWN	LOGGING TRAIL - 3m
6.514	U7045.0	TELUS	TELUS U/G FIBRE OPTIC COMMUNICATIONS CABLE
6.541	T6130.0	BC CROWN	OVERGROWN TRAIL
7.159	T6131.0	BC CROWN	2.5m TRAIL
7.920	T6132.0	BC CROWN	OLD 2.5m TRAIL
7.950	T6133.0	BC CROWN	OLD 2.5m TRAIL
9.238	T6156.0	BC CROWN	RECREATIONAL TRAIL
9.569	T6157.0	BC CROWN	RECREATIONAL TRAIL
9.938	T6158.0	BC CROWN	RECREATIONAL TRAIL
10.371	T6169.0	BC CROWN	ROAD
10.460	P5980.0	ENBRIDGE (WESTCOAST)	ENBRIDGE (WESTCOAST) BURIED PIPE
10.469	P5979.0	ENBRIDGE (WESTCOAST)	ENBRIDGE (WESTCOAST) BURIED PIPE
10.474	T6134.0	BC CROWN	LOW GRADE DIRT ROAD
10.479	U7046.0	TELUS	TELUS U/G FIBRE OPTIC COMMUNICATIONS CABLE
11.091	T6135.0	BC CROWN	DIRT ROAD
11.932	T6161.0	BC CROWN	TRAIL
14.018	T6162.0	BC CROWN	TRAIL
14.170	T6163.0	BC CROWN	TRAIL

Table 2: Summary of Utility Crossings on the West Alternative Route

AK	PXID	Owner	Description
14.252	T6137.0	BC CROWN	LOGGING ROAD
16.425	T6138.0	BC CROWN	LOGGING ROAD
16.988	T6139.0	BC CROWN	KETTLE VALLEY RAIL TRAIL
17.099	T6140.0	MINISTRY OF TRANSPORTATION & INFRASTRUCTURE	PATCHETT ROAD
17.206	U7047.0	BC HYDRO	BC HYDRO O/H DISTRIBUTION
17.206	U7082.0	TELUS	TELUS O/H COMMUNICATIONS CABLE
17.972	U7048.0	TELUS	TELUS U/G FIBRE OPTIC COMMUNICATIONS CABLE
17.986	U7083.0	TELUS	TELUS O/H COMMUNICATIONS CABLE
17.986	U7049.0	BC HYDRO	BC HYDRO O/H DISTRIBUTION
18.009	T6141.0	MINISTRY OF TRANSPORTATION & INFRASTRUCTURE	COLDWATER ROAD

C. Stakeholder Engagement

42. Trans Mountain will acquire the necessary easement interests, permits and rights from private landowners and utility owners (or the Commission, if needed) and Crown licence agreements for the construction, operation, and maintenance of the Project along the West Alternative. As of the date of this Variance Application, Trans Mountain has not yet entered into any agreements with landowners or utility owners. A description of Trans Mountain’s stakeholder (non-Indigenous) engagement efforts to date with respect to the West Alternative follows.

43. Since filing the Feasibility Study, Trans Mountain has been engaging with local stakeholders regarding the West Alternative, including landowners and provincial agencies. Trans Mountain’s stakeholder engagement program with respect to the West Alternative included discussions with the regional government that has jurisdiction over this area. Specifically, on July 20, 2020, Trans Mountain notified the Thompson-Nicola Regional District of Trans Mountain’s intention to explore an alternative route along the west side of the Coldwater Valley. Trans Mountain has not received any feedback from the Regional District since issuing this notification.

44. Trans Mountain is committed to ongoing engagement throughout the life of the Project. Information will continue to be shared with affected stakeholders as the Project progresses.

45. In assessing and pursuing the West Alternative, Trans Mountain has and continues to implement its Landowner Engagement Program, as described in the 2013 TMEP Application, Volume 2, Section 5.4. The purpose of the Landowner Engagement Program is to obtain landowner acceptance and land rights for survey, construction, restoration and transition to operations by providing fair compensation and addressing non-monetary issues in a respectful, sincere, and honest manner.

46. Trans Mountain representatives have contacted and met with all landowners, residents and range tenure holders affected by the West Alternative to discuss the proposed route and review the route on large scale maps. Trans Mountain has not yet met in person with one landowner, as they reside in the Lower Mainland. Trans Mountain has provided mapping of the route to all affected landowners, residents and tenure holders and, in some cases, has received and discussed feedback from those stakeholders.

47. Issues identified through discussions with individual landowners and tenure holders have been recorded by Trans Mountain representatives and entered into the Project landowner database to ensure concerns are considered and addressed. To date, Trans Mountain has received and responded to landowner and tenure holder concerns as follows (see Table 3):

Table 3: Feedback Received from Landowners and Tenure Holders

Concern Noted	Consideration/Action
Poor soil conditions in the Coldwater River crossing. Concerns about ground stability for pipeline construction.	Investigations are underway to confirm the geotechnical conditions at the crossings and to ensure appropriate design.
Impacts to groundwater with pipeline construction on residential properties.	Where construction is required in proximity to an owner’s water wells, baseline samples can be taken prior to construction, and again after construction, if requested by the Landowner.
The proposed Reroute will be constructed through a residential yard along with working ranch facilities. The landowner asked Trans Mountain to consider starting the West Alternate route further to the north to bypass the residence and ranch facilities.	Trans Mountain construction team met with the Owner and reviewed the alternate proposed route. Their review suggested there are constructability issues with the alternate routes that the owner presented.
Logistics of constructing through an active cattle handling facility.	Trans Mountain is committed to work with the landowner to mitigate cattle handling issues and has discussed the potential of supplying temporary cattle handling facilities during construction, if required. Trans Mountain also met with landowner to discuss specific impacts to his operations including underground water lines, overhead power, fencing and access to residence during construction. Project will mitigate impacts with landowner.
Range Land Tenures – No major concerns noted from any of the range land tenures other than requests to work with them during construction to ensure the containment of livestock on their respective lands.	Trans Mountain has committed to working with range land tenure holders during construction to ensure the containment of livestock on affected lands.

D. Plan, Profile and Book of Reference

48. Trans Mountain intends to prepare and file with the CER Plans, Profiles and Books of Reference (PPBoR) for the West Alternative by January 31, 2021. Trans Mountain will also publish and serve associated notices to affected landowners pursuant to sections 201 and 322 of the CER Act at or around the time the PPBoR is filed with the CER.

VIII. JUSTIFICATION FOR PROPOSED VARIANCE

49. Based on the results of the West Alternative ESA, geotechnical and engineering assessments, Trans Mountain determined that the West Alternative is technically feasible and will result in similar environmental effects to the approved East Route. Through its engagement with Coldwater and other parties, Trans Mountain understands that no Indigenous groups or stakeholders have expressed opposition to the West Alternative. Importantly, as noted above, Coldwater has confirmed that the West Alternative addresses its concerns regarding potential impacts to the aquifer relied on by the Coldwater Community and that, subject to further community engagement, it is supportive of the West Alternative and this Variance Application.

50. A summary comparison of the West Alternative and East Route is provided in Table 4, for ease of reference.

Table 4: Comparison of Technical Details – West Alternative and Approved East Route

Feature	West Alternative	East Route
Total Length (km)	18.4	15.45
Greenfield Section (km)	3.99	10.30
Valves	Minimum of 4 valves are being considered - one on either side of the two Coldwater River crossings.	1
Access Bridge	1 bridge may be required to cross the Coldwater River at the #1a location.	No bridge required
Number of Crossings (total)	**47**	**38**
Named Roads	7	9
Pipelines (total)	3	4
• *Enbridge (Spectra)*	2	2
• *Fortis BC*	1	0
• *TMPL*	0	2
Telus FOTS Cable	5	1

Powerline	4	2
Watercourses and Drainages (excluding Coldwater River)	26	22
Coldwater River	2	0

IX. COMMUNICATIONS

51. All notices and communications relative to this Application should be directed to:

Mr. D. Scott Stoness
Vice President, Regulatory and Compliance
Trans Mountain Pipeline ULC
Suite 2700, 300 – 5 Ave SW
Calgary, AB T2P 5J2
Email: regulatory@transmountain.com

Mr. Sander Duncanson
Osler, Hoskin & Harcourt LLP
Suite 2500, 450 1 Street SW
Calgary, AB T2P 5H1
Email: regulatory@transmountain.com

X. RELIEF SOUGHT

A. Approval of Variance Application

52. Trans Mountain respectfully requests approval of this Variance Application pursuant to section 190 of the CER Act such that the Project Corridor approved by Certificate OC-065 (the East Route) and related orders[6] is amended to reflect the West Alternative, as shown above in Figure 1. Trans Mountain further requests that the Commission determine that the potential adverse effects associated with the proposed realignment of the Project are consistent with those already assessed during the prior proceedings leading to the issuance of Certificate OC-065.

B. Condition Compliance

53. In addition, in the event this Variance Application is approved, Trans Mountain understands that it will need to update or supplement its pre-construction Project condition compliance plans and related filings to reflect the West Alternative, as applicable. The table attached as **Appendix D** hereto lists the conditions attached to Certificate OC-065 and related orders and the corresponding modifications or updates to Condition filings

---

[6] Specifically, CER Orders AO-001-XO-T260-007-2016 (Temp) and AO-002-XO-T260-009-2016 (Pump 2) (removal of Condition 39).

that, in Trans Mountain's view, are required to reflect the West Alternative, if approved. These changes apply to Project Phase 31, as defined pursuant to Condition 10.

54. Trans Mountain intends to submit the required updated condition filings or supplemental reports to satisfy pre-construction condition requirements by April 30, 2021. To the extent that this timing does not align with the timing requirements in condition wording, Trans Mountain respectfully requests relief from those timing requirements. EAS and RSMTs will be updated based on spring/summer fieldwork, if necessary, one month prior to construction.

C. Process

55. To allow Trans Mountain to achieve its planned in-service date of December 2022, Trans Mountain respectfully requests that the Commission establish a process for the consideration of this Variance Application such that the Commission can provide a decision on the Variance Application and issue ancillary approvals (such as PPBoR sheets and decisions on applicable pre-construction conditions) to enable construction to start by no later than August 2021. This implies a CER decision in April 2021 and subsequent GIC approval, if required, prior to August 2021. As indicated above, Trans Mountain intends to satisfy filing and service obligations associated with the West Alternative PPBoR and applicable Project conditions sufficiently in advance to enable the Commission to review, consider and issue required authorizations (should it deem it appropriate to do so) before the start of construction in August 2021.

APPENDICES

Appendix A-1 Engineering Information – Coldwater Variance Footprint Drawings.

STRIP 1

STRIP 2

STRIP 3

CLIENT ACCEPTANCE

NO.	DESCRIPTION	DATE	ACC
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	

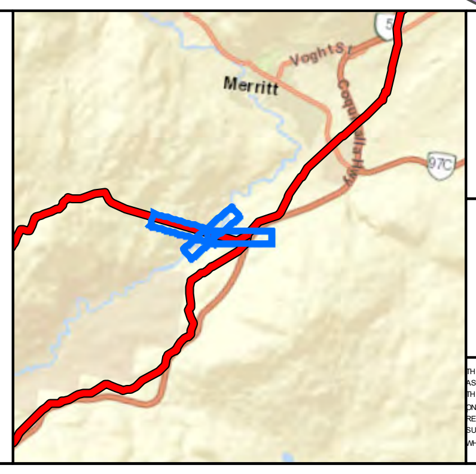
REV	DESCRIPTION	DATE	DRN	CKD	APP
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	ZSN	DCL	GF
0	ISSUED FOR INFORMATION, AFE 01-13283	2020/08/19	ZSN	DCL	GF

LEGEND

▲	TMEP KP	▨	TEMPORARY	—	ROADS
—	EXISTING TMPL	▨	EXTRA TEMPORARY WORKSPACE	- · -	FOTS (APPROXIMATE)
—	PROPOSED	▨	EASEMENT	·····	CABLES
		▨	LOG DECK	—●—	POWER LINE (MAIN)
		🟩	SHOOFLY	- - -	SPECTRA
				▨	LAKES AND

0 200
METRES

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N



TRANS MOUNTAIN

UniversalPegasus
INTERNATIONAL
A Subsidiary of Huntington Ingalls Industries

TRANS MOUNTAIN PIPELINE

TRANS MOUNTAIN EXPANSION PROJECT

FOOTPRINT DRAWINGS: COLDWATER WEST ALTERNATIVE

SCALE	ROUTE	DRAWING NUMBER	SHEET NO.	REV
1:2,500	005.19.3	M002-PM06081	1	1

STRIP 1

STRIP 2

STRIP 3

CLIENT ACCEPTANCE

NO.	DESCRIPTION	DATE	ACC
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	

REV	DESCRIPTION	DATE	DRN	CKD	APP
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	ZSN	DCL	GF
0	ISSUED FOR INFORMATION, AFE 01-13283	2020/08/19	ZSN	DCL	GF

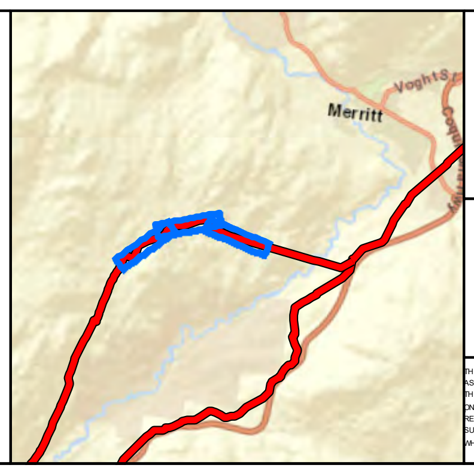
LEGEND

▲	TMEP KP	▢	TEMPORARY	—	ROADS
🟨	EXISTING	🟪	EXTRA TEMPORARY WORKSPACE	-·-	FOTS (APPROXIMATE)
🟥	PROPOSED	▨	EASEMENT	·····	CABLES
		🟧	LOG DECK	-●-	POWER LINE (MAIN)
		🟩	SHOOFLY	- -	SPECTRA
				🟦	LAKES AND

0 200

METRES

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N



TRANS MOUNTAIN PIPELINE

TRANS MOUNTAIN EXPANSION PROJECT

FOOTPRINT DRAWINGS:
COLDWATER WEST ALTERNATIVE

SCALE	ROUTE	DRAWING NUMBER	SHEET NO.	REV
1:2,500	005.19.3	M002-PM06081	2	1

SIZE: ISO A1 - VERSION: A

STRIP 1

STRIP 2

STRIP 3

CLIENT ACCEPTANCE			
NO.	DESCRIPTION	DATE	ACC
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	

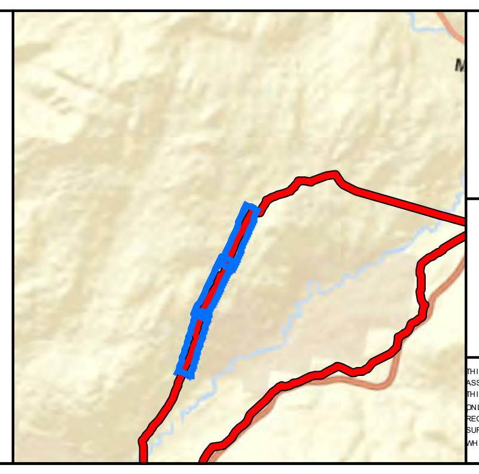
REV	DESCRIPTION	DATE	DRN	CKD	APP
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	ZSN	DCL	GF
0	ISSUED FOR INFORMATION, AFE 01-13283	2020/08/19	ZSN	DCL	GF

LEGEND

▲	TMEP KP	▨	TEMPORARY	—	ROADS
—	EXISTING	▨	EXTRA TEMPORARY WORKSPACE	- · -	FOTS (APPROXIMATE)
—	PROPOSED	▨	EASEMENT	·····	CABLES
		▨	LOG DECK	—●—●	POWER LINE (MAIN)
		🟩	SHOOFLY	- - -	SPECTRA
				▨	LAKES AND

0 200
METRES

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N



TRANS MOUNTAIN

UniversalPegasus
INTERNATIONAL
A Subsidiary of Huntington Ingalls Industries

TRANS MOUNTAIN PIPELINE

TRANS MOUNTAIN EXPANSION PROJECT

FOOTPRINT DRAWINGS: COLDWATER WEST ALTERNATIVE

SCALE	ROUTE	DRAWING NUMBER	SHEET NO.	REV
1:2,500	005.19.3	M002-PM06081	3	1

SIZE: ISO A1 - VERSION: A

STRIP 1

STRIP 2

STRIP 3

CLIENT ACCEPTANCE			
NO.	DESCRIPTION	DATE	ACC
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	

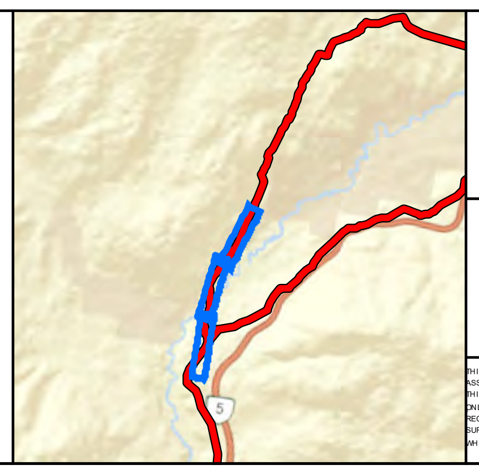
REV	DESCRIPTION	DATE	DRN	CKD	APP
1	ISSUED FOR INFORMATION, AFE 01-13283	2020/09/28	ZSN	DCL	GF
0	ISSUED FOR INFORMATION, AFE 01-13283	2020/08/19	ZSN	DCL	GF

LEGEND

▲	TMEP KP	▨	TEMPORARY	—	ROADS
—	EXISTING	▨	EXTRA TEMPORARY WORKSPACE	- · -	FOTS (APPROXIMATE)
—	PROPOSED	▨	EASEMENT	······	CABLES
		▨	LOG DECK	—●—	POWER LINE (MAIN)
		🟩	SHOOFLY	- - -	SPECTRA
				▨	LAKES AND

0 200
METRES

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N



TRANS MOUNTAIN PIPELINE

TRANS MOUNTAIN EXPANSION PROJECT

FOOTPRINT DRAWINGS:
COLDWATER WEST ALTERNATIVE

SCALE	ROUTE	DRAWING NUMBER	SHEET NO.	REV
1:2,500	005.19.3	M002-PM06081	4	1

SIZE: ISO A1 - VERSION: A

Appendix A-2 Engineering Information – Geotechnical HDD Feasibility Assessment – Coldwater IR South at SSEID005.19.2 – AK 16.5

Trans Mountain Expansion Project

Geotechnical HDD Feasibility Assessment Coldwater IR South at SSEID 005.19.2

AK 16.5

TMEP Document # 01-13283-S5A-M002-PL-RPT-0013 RA

Rev No.	Prepared by/ Date	Reviewed by/ Date	Approved by/ Date	Reviewed by TMEP	Pages Revised	Issued Type
A	Heather Hughes-Adams 2020-09-02 Matt Thompson 2020-09-02	Pete Quinn 2020-09-02	Alex Baumgard 2020-09-02			Issued for Review

TRANS MOUNTAIN PIPELINE ULC

TRANS MOUNTAIN EXPANSION PROJECT

GEOTECHNICAL HDD FEASIBILITY ASSESSMENT
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

PROJECT NO.: 1321150-43
DATE: September 2, 2020
DOCUMENT NO.: TMEP20-057

EXECUTIVE SUMMARY

As part of the engineering design and assessment for the Trans Mountain Expansion Project (TMEP), BGC Engineering Inc. (BGC) has been retained to complete geotechnical feasibility assessments for trenchless crossings at select watercourse and overland crossings along the proposed pipeline corridor. A trenchless crossing by horizontal directional drilling (HDD) is proposed for the Coldwater River crossing located at SSEID 005.19.2 AK 16.5 along the Coldwater IR Western Alternative Route.

The scope of work for this assessment included a desktop review of the relevant regional and local geological settings, the drilling of four geotechnical boreholes, geophysical surveys, a hydrotechnical assessment and the compilation and interpretation of these data to provide, from a geotechnical perspective, an indication of the feasibility of the proposed horizontal directional drill (HDD).

In November 2019, BGC supervised the drilling of two boreholes on the south bank of the river adjacent to the proposed HDD crossing. In May 2020, geophysical surveys were completed by Advisian. Two additional boreholes were supervised by BGC in July 2020 on the north bank of the crossing.

The stratigraphy observed in three of the four boreholes generally consisted of fluvial sand and gravel deposits overlying silt, sand and gravel glacial till deposits. The density of the near surface fluvial deposits generally ranged from loose to very dense (Standard Penetration Test [SPT] N-values between 8 to refusal). The density of the underlying glacial till deposits, in which the majority of the HDD profile resides, ranged from dense to very dense (SPT N-values between 43 and refusal). Occasional cobbles and gravel layers were inferred from drilling action in the fluvial and glacial till deposits. An inferred fluvial over bank deposit consisting of soft to firm silt was encountered in the borehole nearest the HDD exit point (BH-BGC19-CW5-01). A glaciofluvial gravel and sand unit with artesian groundwater pressure was encountered in the borehole on the south bank of the Coldwater River (BH-BGC19-CW5-03). This glaciofluvial unit coincides with the approximate elevation of the proposed HDD invert. Colluvium, consisting of gravel and sand, was observed in the upper 5 m at BH-BGC20-CW5-04. Volcanic bedrock of the Spences Bridge Group was encountered in two of four boreholes (BH-BGC20-CW5-02 and -04), however is not expected to be encountered along the proposed HDD borepath.

Drill fluid returns were generally high (approximately 80 to 90%) throughout investigative drilling, with the exception of the near surface fluvial sand and gravel unit encountered in the two boreholes (BH-BGC19-CW5-01 and -03) on the south bank of the river between 8 to 12 m depth.

Analysis of historical aerial photographs shows that the banks of the Coldwater River are mobile and have migrated approximately 50% of the current bankfull width (85 m) at the crossing over 53 years.

Results from the hydraulic analysis indicate that the HDD exit point will not be inundated in a 200-year flood due its location approximately 8 m above expected flood levels. The north bank

could be overtopped for flood magnitudes greater than those of the 10- to 20-year flood events and this would inundate the HDD entry point and trenched pipe on the northern floodplain. Moreover, an avulsion hazard exists on the north floodplain, though this hazard is unlikely to pose an immediate threat to the pipeline in response to an individual flood event

Given the above, and based on observations from the geotechnical boreholes and interpretations from the geophysical surveys, an HDD crossing at this location can be considered feasible from a geotechnical perspective provided the following concerns can be addressed during detailed design and construction:

- <u>Presence of cobbles or boulders.</u> Cobbles were inferred from drill action within the fluvial, glaciofluvial and till units in which the majority of the proposed HDD borepath resides. Although not inferred from investigative drilling, boulders may also be encountered. The presence of large clasts may result in borepath instability, steering challenges, possible jamming of reamers and possible damage to the product line during pull through.
- <u>Presence of gravel unit with artesian groundwater pressure.</u> A gravel and sand unit was encountered below 35 m in BH-BGC19-CW5-03, which coincides with the approximate elevation of the HDD invert. Artesian groundwater pressure was encountered within this unit; however, it did not pose a significant challenge during investigative drilling. Artesian ground pressure may dilute drill mud during HDD drilling. Gravel layers and cobbles in this unit may result in borepath instability, steering challenges, possible jamming of reamers and possible damage to the product line during pull through.
- <u>Potential for hydraulic fracturing and drill fluid loss.</u> Low to Moderate (0% to 60%) drilling mud returns were experienced in the loose to very dense fluvial sand and gravel unit encountered near the ground surface. This was observed between 8 to 12 m depth in the boreholes on the south banks on the river (BH-BGC20-CW5-01 and -03). Zones of drill fluid loss and poor circulation should be expected in the fluvial sand and gravel unit and the potential for hydraulic fracture and release to the Coldwater River should be assessed by the HDD designer and contractor during detailed design and construction.
- <u>Flood and avulsion hazard on the north bank.</u> The HDD entry point near the north bank of the river is located within a low-lying floodplain and hydrologic modelling indicates it may become inundated in a 10- or 20-year flooding event. The HDD entry point and the conventionally trenched pipe further north on the floodplain are also exposed to avulsion hazard. Flood protection measures may be considered to limit the potential for threats from bank erosion, flood inundation and avulsion; alternatively, a different profile could be considered extending beyond the floodplain to the north.

The conclusions presented herein are based solely on the limited scope of the investigation undertaken at this time for the purpose of obtaining information associated with preparation of a geotechnical feasibility assessment.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF DRAWINGS

LIMITATIONS

BGC Engineering Inc. (BGC) prepared this document for the account of Trans Mountain Pipeline ULC (Trans Mountain). The material in this report reflects the judgment of BGC staff based upon the information made available to BGC at the time of preparation of the report, including that information provided to it by Trans Mountain. Any use which a third party makes of this report or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility whatsoever for damages, loss, expenses, loss of profit or revenues, if any, suffered by any third party as a result of decisions made or actions based on this report.

As a mutual protection to our Client, the public and BGC, the report, and its drawings are submitted to Trans Mountain as confidential information for a specific project. Authorization for any use and/or publication of the report or any data, statements, conclusions or abstracts from or regarding the report and its drawings, through any form of print or electronic media, including without limitation, posting or reproductions of same on any website, is reserved by BGC, and is subject to BGC's prior written approval. Provided however, if the report is prepared for the purposes of inclusion in an application for a specific permit or other government process, as specifically set forth in the report, then the applicable regulatory, municipal, or other governmental authority may use the report only for the specific and identified purpose of the specific permit application or other government process as identified in the report. If the report or any portion or extracts thereof is/are issued in electronic format, the original copy of the report retained by BGC will be regarded as the only copy to be relied on for any purpose and will take precedence over any electronic copy of the report, or any portion or extracts thereof which may be used or published by others in accordance with the terms of this disclaimer.

1.0 PROJECT DESCRIPTION

Trans Mountain Pipeline LP (Trans Mountain) is a Canadian corporation with its head office located in Calgary, Alberta (AB). Trans Mountain is operated by Trans Mountain Canada Inc. (TMCI) and is fully owned by the Canada Development Investment Corporation. Trans Mountain is the holder of the National Energy Board (NEB)[1] certificates for the Trans Mountain pipeline system (TMPL system).

The TMPL system commenced operations in 1953 and now transports a range of crude oil and petroleum products from Western Canada to locations in central and southwestern British Columbia (BC), Washington State, and offshore. The TMPL system currently supplies much of the crude oil and refined products used in BC.

In December 2016, the NEB granted approval for the Trans Mountain Expansion Project (referred to as “TMEP” or “the Project”) under Section 52 of the *National Energy Board Act* (*NEB Act*). The proposed expansion will comprise the following:

- Pipeline segments that complete a twinning (or “looping”) of the pipeline in Alberta (AB) and BC with about 987 km of new buried pipeline
- New and modified facilities, including pump stations and tanks
- Three new berths at the Westridge Marine Terminal in Burnaby, BC, each capable of handling Aframax class vessels.

The Project NEB re-consideration report was issued in February 2019 and the Project was re-approved in June 2019 by the Canadian Government.

As part of the design process for the twinning of the pipeline, geotechnical and hydrotechnical investigations are being undertaken at select watercourse crossings and where the pipeline will be installed by trenchless methods to avoid existing infrastructure. These investigations support the feasibility assessments for establishing the preferred crossing methodology, and where appropriate, contingency options.

Trans Mountain is considering an alternative route for TMEP which deviates from the existing TMPL corridor south of Merritt, British Columbia, between SSEID 005.19 KP 931.4 and 946.9. The alternative route, herein referred to as the Coldwater IR Western Alternative route, crosses the Coldwater River twice and traverses the west side of the valley around the Coldwater Indian Reserve (IR). The Coldwater IR Western Alternative route is referred to as SSEID 005.19.2 and was provided by Universal Pegasus International (UPI) on August 20, 2020.

---

[1] The National Energy Board (NEB) became the Canada Energy Regulator (CER) on August 28, 2019.

2.0 SCOPE OF WORK

As part of the engineering design and assessment for installing new sections of pipeline, Trans Mountain have retained BGC Engineering Inc. (BGC) to complete geotechnical feasibility assessments for horizontal directional drilling (HDD) at select stream crossings along the proposed pipeline corridor. The proposed TMEP alignment crosses the Coldwater River at four separate locations hereafter referred to as Coldwater River 1, Coldwater River 2, Coldwater River 3, Coldwater River 4. The Coldwater IR western alternative route adds two additional Coldwater River crossings, hereafter referred to as the Coldwater IR south crossing and the Coldwater IR north crossing. This report addresses geotechnical feasibility for the Coldwater IR south crossing.

The scope of work for the feasibility assessment of the Coldwater IR south crossing included the following:

- Desktop study including a review of:
    - The published literature on the regional geology and the local geological setting at the HDD crossing.
    - Existing BGC geotechnical information pertaining to a geohazard assessment of the crossing completed in 2020 (BGC, January 31, 2020).
    - The 1:20,000 scale terrain mapping assessment (BGC, January 31, 2020) along the pipeline corridor.
- Drilling of four geotechnical boreholes adjacent to the proposed HDD crossing (supervised by BGC).
- Review of geophysical seismic refraction and electrical resistivity tomography surveys along the proposed HDD crossing completed by Advisian under subcontract to BGC.
- A hydrotechnical assessment of the site, consisting of a flood frequency analysis and assessment of hydrotechnical hazards including scour and lateral migration.
- Compilation and interpretation of this data, and the assessment of geotechnical and hydrotechnical feasibility for the proposed HDD crossing.

Planning for contingency river crossing methods is outside the scope of this study and will be addressed by the pipeline design engineer for the portion of the route under consideration, in this case, Universal Pegasus International Ltd. (UPI). As such, no comments on the applicability of the current route to alternate crossing methods are provided herein.

The purpose of this report is to summarize the anticipated geotechnical site conditions at the proposed Coldwater IR south crossing and to provide an indication, from a geotechnical perspective, of the feasibility of HDD technology as a crossing method.

3.0 SITE GEOLOGY

3.1. Overview

The Coldwater IR south crossing along the Coldwater IR Western Alternative route is situated approximately 16 km southwest of Merritt, BC. The site is located at AK 16.5 along the SSEID 005.19.2 route issued by UPI on August 10, 2020. The location of the site along the SSEID 005.19.2 western alternative alignment (red dashed line), and the SSEID 005.19 alignment (solid yellow line) are shown below in Figure 3-1.

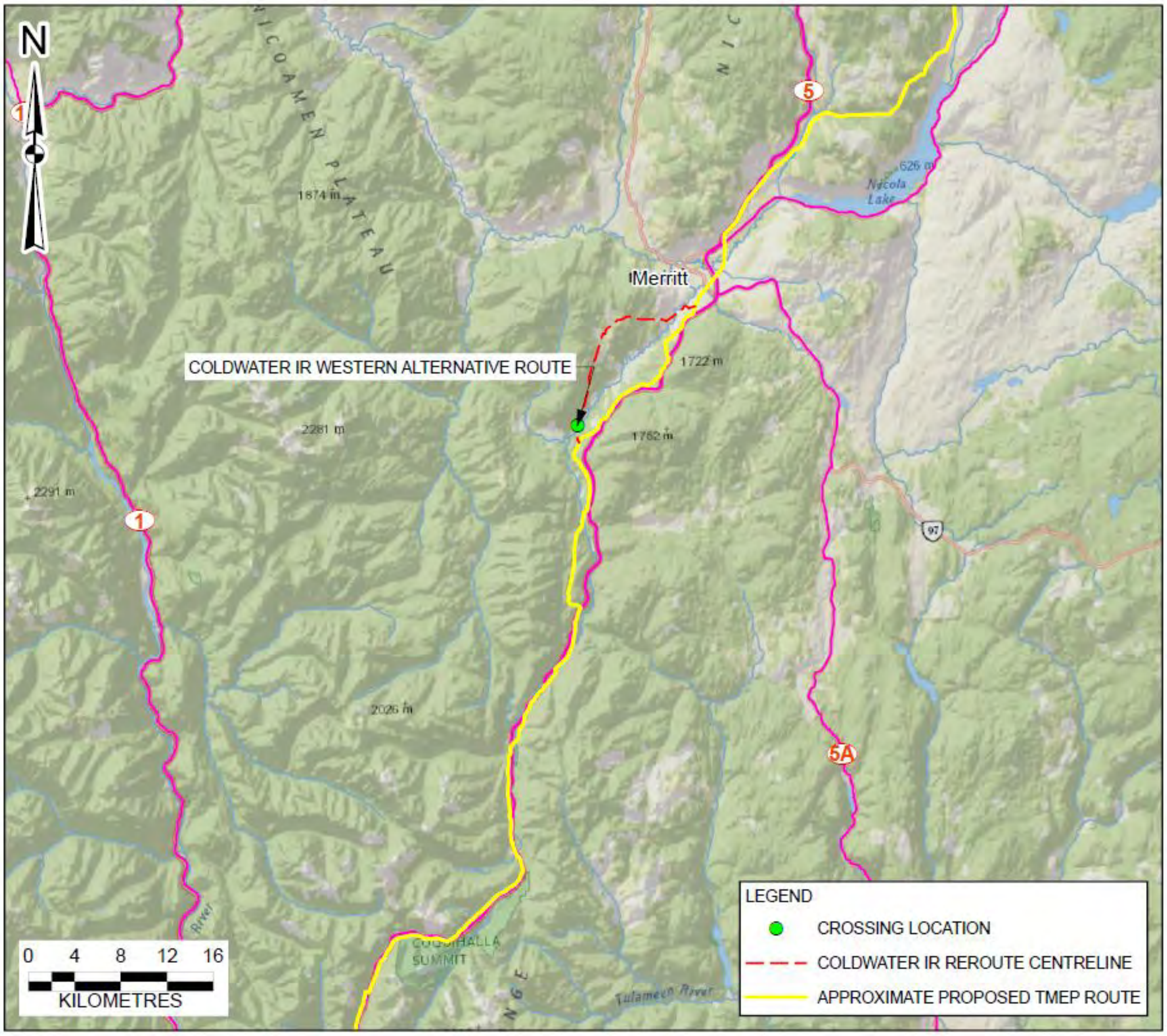


Figure 3-1. Overview of proposed crossing location.

The proposed crossing is located within the Coldwater River valley, west of the intersection of Coldwater Road and Patchett Road. An Enbridge pipeline crosses the Coldwater River at the same location approximately 60 m to the east. At this point, the Coldwater River has a bankfull width of approximately 85 m and flows to the north (Drawings 01 and 02). The proposed borepath is approximately 500 m long and reaches a maximum depth of 35 m beneath the floor of the Coldwater River valley.

3.2. Surficial Geology

The crossing is within the physiographic subregion of the Thompson Plateau, part of the Interior Plateau region, a high elevation plateau located between the Coast and Columbia Mountain Ranges in the Canadian Cordillera. At the maximum of the Fraser Glaciation, ice flowed as a continental ice dome across the Interior Plateau to the south, at times discordantly across present topographic features (Tipper, 1970; Ryder et al., 1991). During glaciation and post-glaciation, till and glaciofluvial materials were deposited in large volumes. Post-glacial and modern rivers eroded and modified these deposits to form terraces along existing fluvial channels. Stagnant ice present during deglaciation created blockages of the drainage network, forming glacial lakes into which large volumes of sediment were deposited (Ryder et al., 1991). Pre-glacial sediments have been mapped along valley walls (Fulton, 1975; 1976), and reflect pre-Fraser Glaciation glacial and non-glacial environments (Fulton & Smith, 1978).

The dominant surficial materials of the Thompson Plateau are fluvial, glaciofluvial, colluvium, till, bedrock, and glaciolacustrine (Tipper, 1970; Fulton, 1975; 1976; Bednarski, 2009). Till deposits mantle and blanket valley walls and upland surfaces. Colluvial deposits are common along valley slopes and in fans and cones. Plains and terraces are composed of active fluvial, glaciofluvial, and glaciolacustrine deposits. Overburden thickness may be thin along high valley walls and ridge tops, and thickest in valley bottoms. Active fluvial deposits are characterized as well sorted sands, gravels, silts and minor organic materials (Fulton, 1975; 1976). Inactive fluvial fan deposits contain poorly sorted gravels, sands, silts, and clays (Fulton, 1975; 1976). Glaciolacustrine deposits are typically laminated silts with lesser amounts of clay and sand (Fulton, 1975; 1976). Glaciofluvial sediments are commonly sands and gravels (Bednarski, 2009). Tills comprise poorly sorted sands, gravels, and silts with variable clast content (Fulton, 1975; 1976). Bedrock outcrops are common, and may include lesser amounts of weathered bedrock, colluvium, and till deposits.

3.3. Bedrock Geology

The Thompson Plateau is characterized by the rocks of the Quesnellia Terrane (Journeay et. al., 2000). The primary bedrock units in this area are from the Nicola Group consisting mainly of volcanic and metasedimentary units with localized outcrops of high-grade metamorphosed rocks (amphibolites). The Nicola Group is mapped by Cui et al. (2000) 1 km east of the Coldwater IR south site. The site itself however is underlain by bedrock from the Pimainus Formation of the Spences Bridge Group. This bedrock is comprised of andesitic volcanic rocks and is primarily andesitic flows and breccias with some volcanic sandstones, shales and conglomerates.

3.4. Terrain Mapping

In 2020, BGC updated the terrain map along the Coldwater IR Western Alternative route. BGC mapped the pipeline corridor at a scale of 1:20,000 by analyzing air photos, satellite imagery, and LiDAR topography. Local variations in terrain over areas of about 2 to 3 hectares, or over distances of less than approximately 150 meters may not be captured in the scale of terrain mapping. Terrain mapping for the Coldwater IR South crossing is shown in Drawing 03A and described below. A terrain legend is included in Drawing 03B.

3.4.1. Terrain Types

Terrain types in the vicinity of the Coldwater IR south crossing are as follows:

A. Fluvial/Glaciofluvial
The primary terrain type mapped at the HDD crossing is fluvial plain and terrace deposits. Fluvial and glaciofluvial material is predominately composed of sand and gravel deposited by surface water and meltwater steams. Cobbles and boulders may also be present. Fluvial and glaciofluvial deposits may contain lesser amounts of silts that can be deposited in low flow settings such as overbank flooding or blockages downstream.

B. Till
Till is material deposited by glacial ice. It is often consolidated by the weight of the glacier; it is usually poorly sorted (i.e., broadly graded) and most often matrix supported. Till is mapped on the upper valley walls in the vicinity of the proposed crossing.

C. Colluvium
Colluvium is material that has weathered and eroded from bedrock or other deposits and has been moved downslope by gravity. It is common as a thin veneer (< 1 m thick) on rocky slopes and as thicker deposits at the base of slopes which have experienced slumping or land sliding. The texture of colluvium reflects its source; where derived from bedrock, colluvium will typically be silt to gravel sized with some boulders and highly disturbed bedrock. Colluvium is mapped on the north side of the river at the proposed crossing location, below exposed bedrock outcrops on the valley walls.

D. Glaciolacustrine
Glaciolacustrine material was deposited into lakes that formed near the onset and end of the last glacial period. Typically, this material consists of interbedded sand, silt and clay. An isolated area west of the crossing was mapped as glaciolacustrine deposits on the surface.

E. Bedrock
Steeply dipping (>35°) exposed bedrock is mapped approximately 350 m northeast of the HDD entry point. Bedrock is also mapped on the valley walls south of the crossing, though at a greater distance from the HDD exit point (approximately 1500 m).

4.0 HYDROTECHNICAL ASSESSMENT

Historical air photos, LiDAR data acquired from Airborne Imagery in 2019, and site observations were used to assess the potential for hydrotechnical hazards to impact the proposed pipeline. Hazards evaluated include flood inundation, bank erosion, scour, and avulsion. The methodologies used to complete this hazard assessment are presented in Appendix A.

4.1. Crossing Description

The Coldwater River has a wandering morphology at the Coldwater IR south crossing, as evidenced by its irregularly meandering pattern and the presence of intermittent side channels separated from the main channel by vegetated islands. The channel is confined on its right (south) bank by an elevated fluvial terrace. A low-lying floodplain approximately 180 m wide extends north of the channel to the toe of the north valley slope and is densely vegetated with trees.

Previous construction works in the vicinity of the crossing are visible in 1981 air photos. A 100 m long berm is present along the north bank of the northern side channel. It begins 25 m upstream of the proposed alignment and extends downstream across the Enbridge right-of-way (RoW). This berm has an approximate crest elevation of 721 m (based on LiDAR) and is assumed to have been constructed to prevent lateral migration of the channel to the north at the Enbridge RoW. A new bridge was also constructed 760 m southwest of the crossing around that time.

4.2. Flood Frequency Analysis

Flood quantiles at the Coldwater IR south crossing were estimated using a flood frequency analysis (FFA). The drainage area at the crossing is estimated to be 718 km^2 and a prorated FFA was used to estimate peak instantaneous streamflow (Q_{IMAX}) for various return periods. This FFA is based on the Water Survey of Canada hydrometric station *Coldwater River near Merritt* (08LG010), which has a record length of 64 years between 1913 and 2016. This station has a published drainage area of 917 km^2. Flows on the Coldwater River are regulated by numerous small dams on the river's tributaries, but these dams are not expected to have a significant impact on peak flows.

The FFA approach adopted for this report uses extreme value statistics based on the assumption of stationarity. The presence of a possible temporal trend in the time series of historical peaks flows was investigated. Because no statistically significant trend was found in the peak flow time series, flood quantiles were increased by 10% to account for the possible influence of a changing climate on flood extremes, as recommended by Engineers and Geoscientists British Columbia (EGBC, 2018). Peak instantaneous streamflow estimates at the Coldwater IR south crossing for various return periods are shown in Table 4-1.

Table 4-1. Peak instantaneous flow (Q_{IMAX}) estimates for the Coldwater IR south crossing.

Pipeline Crossing	Basin Area (km^2)	Q_{IMAX} for Given Return Periods (m^3/s)						
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	200-yr
Coldwater River IR South	718	75	100	115	135	150	165	180

Note: Peak instantaneous flow (Q_{IMAX}) values were rounded to the nearest $5m^3/s$.

4.3. Flood Hydraulics

Two-dimensional (2D) modelling of the flow hydraulics within the reach of the Coldwater IR south crossing was completed using HEC-RAS, a public domain hydraulic modeling program developed and supported by the United States Army Corps of Engineers.

Simulations were based on a 1 m Digital Elevation Model (DEM) derived from the 2019 bare earth LiDAR survey of the Merritt corridor. Where water was ponded or flowing at the time the LiDAR was flown, the resulting DEM captured the water surface elevation instead of the underlying terrain surface. Therefore, the DEM used in the hydraulic simulations did not capture channel bathymetry. The model domain extended approximately 660 m upstream, and 2,200 m downstream of the proposed crossing, respectively.

The computational mesh consisted of approximately 11,100 cells, with an average cell size of 96 m^2. A composite terrain roughness (Manning's roughness coefficient 'n') of 0.04 was used throughout the entire model domain to account for the presence of a gravel bed channel, and vegetation in the floodplain. Flood hydraulics were assessed for the range of flows presented in Table 4-1.

Model simulations indicated that the channel's banks were overtopped, and lower lying parts of the floodplain inundated for flood magnitudes equal to or greater than the 2-year flood (74 m^3/s).

Modelled water surface elevation varied across the borepath, as the borepath is not perpendicular to the flow direction. Where the proposed borepath intersects the main channel, the water surface elevation was 720.9 m for the 200-year flood event.

Maximum flow depth in the main channel increased from 1.1 m for a 2-year flood to 1.5 m for a 200-year flood. Maximum flow velocity in the main channel increased from 1.4 m/s for a 2-year flood to 2.1 m/s for a 200-year flood. Simulated water depths for the 200-year flood event are illustrated in Figure 4-1.

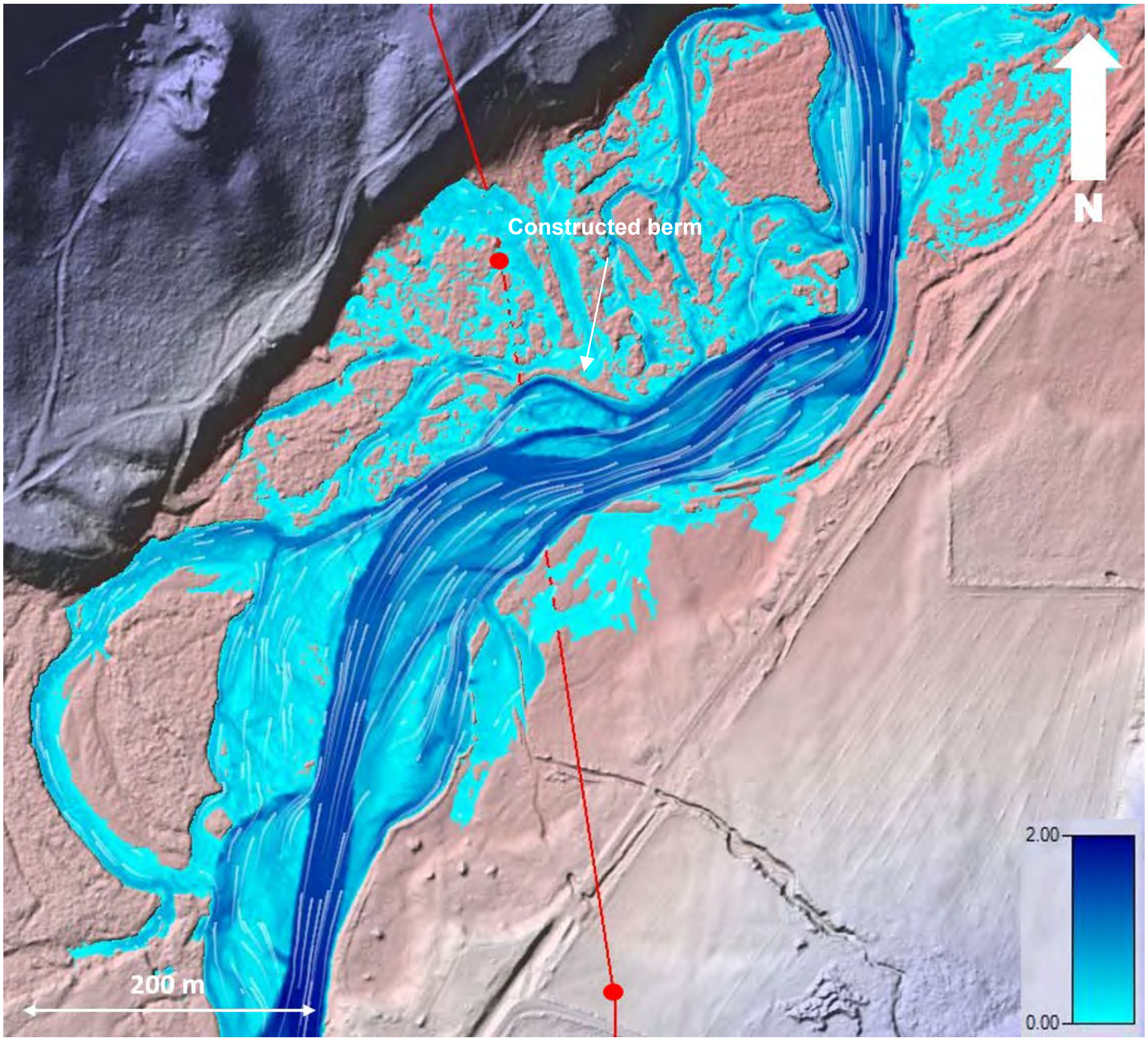


Figure 4-1. Simulated water depths (m) for the 200-year flood event. The approximate proposed HDD entry and exits locations are marked with a red dot.

Simulated 200-year flood conditions suggest that the north (left) floodplain would be entirely inundated with water depth ranging between over a meter in relic channels to less than 0.1 m in local depressions, although flow velocity is not expected to exceed 0.6 m/s. Conversely, these simulated conditions suggest that flooding in the south (right) floodplain would be marginal, with flow depth in the floodplain less than 0.1 m and flow velocity less than 0.4 m/s. Simulated flow velocities for the 200-year flood event are illustrated in Figure 4-2.

Because the channel bathymetry was not captured in the DEM, the simulated channel conveyance was underestimated, resulting in flow depths and velocities in the floodplains being overestimated.

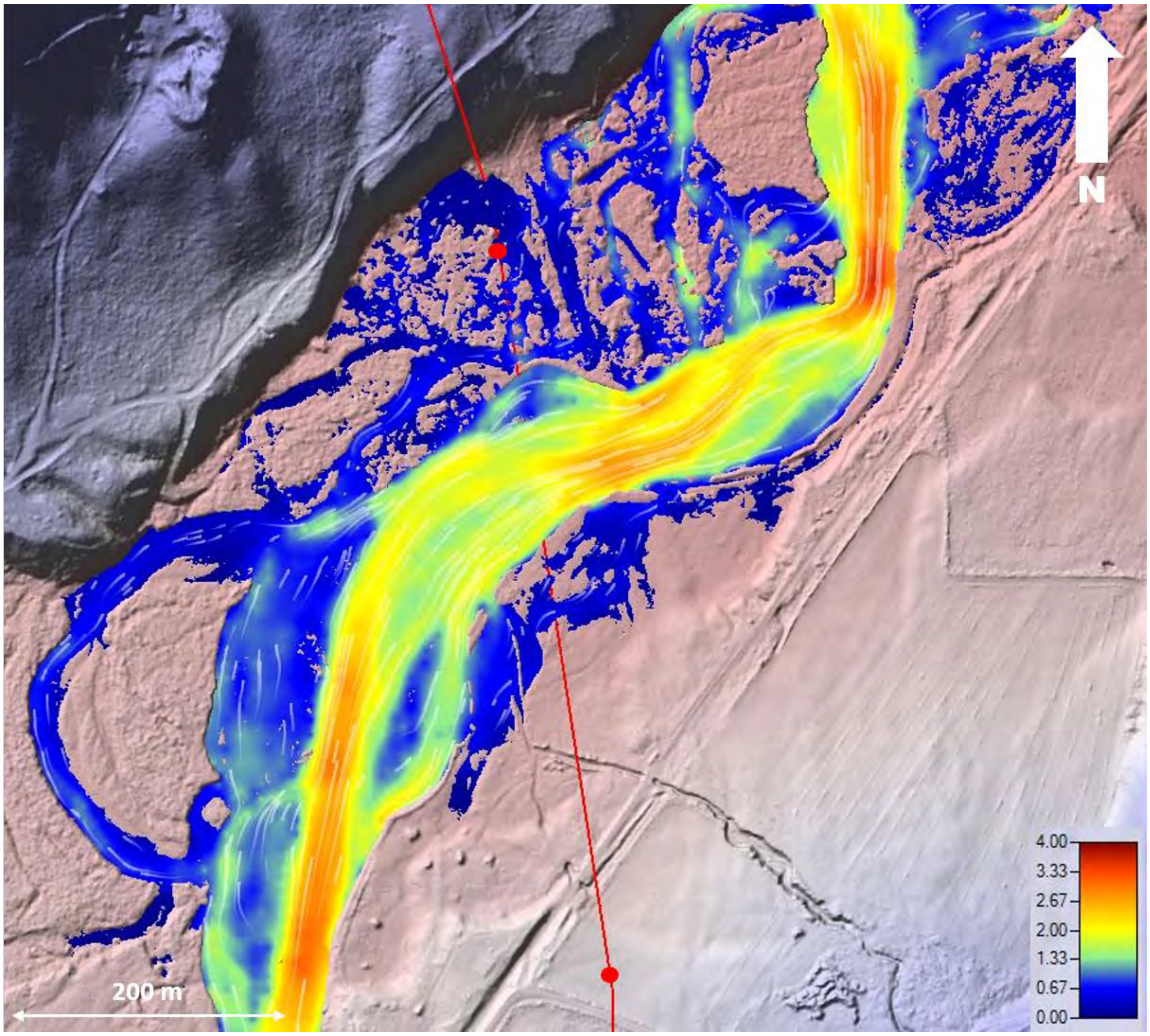


Figure 4-2. Simulated flow velocities (m/s) for the 200-year flood event. The approximate proposed HDD entry and exit locations are marked with a red dot. Flow direction is from south to north in this figure.

4.4. Scour

BGC completed a scour analysis to evaluate general scour conditions at the proposed crossing of the Coldwater River. The analysis was conducted using the estimated peak flows presented in Table 4-1. The channel thalweg elevation was assumed to be 718.0 m at the proposed crossing because in was not captured in the LiDAR DEM and was therefore unknown.

Results estimate a maximum potential scour depth of approximately 1 m below thalweg elevation during a 200-year flood event. The elevation of maximum scour is 717.0 m and is shown on Drawing 04. The depth of cover (DoC) above the proposed HDD borepath remains greater than 20 m should this amount of scour occur. Given these results, scour of the channel bed is not considered a hazard to the proposed HDD borepath.

Hydraulic simulations indicate that the proposed HDD entry point located in the north (left) floodplain at elevation 720.0 m would be submerged in a 10- to 20-year flood event, or greater. Erosion in the north floodplain is unlikely because simulated flow velocities in this floodplain were less than 0.6 m/s and dense vegetation increases roughness and inhibits the development of incised channels. The simulated 200-year water surface elevation in the south (right) floodplain was 721.5 m. Given the elevation of the proposed HDD exit point of 729.1 m, submergence of, and erosion at the exit point is not expected for floods up to the 200-year flood event.

4.5. Bank Erosion

BGC completed an evaluation of the historical lateral stability of the Coldwater River in the vicinity of the crossing by comparing historical air photos between 1960 and 1996 with ESRI world imagery from July 2013. See Table 4-2 for the complete list of photos used in the analysis. The air photos were georeferenced as part of the analysis and Drawing 01 and 02 demonstrate how the channel planform has changed between 1960 and 2013.

Table 4-2. Coldwater IR south historical air photo database.

Ref No.	Photo No.	Date	Scale (Approx.)
BCC96035	202	1996	1:15,000
BCC91014	178	1991	1:15,000
BC81115	264	1981	1:20,000
A19188	170	1969	1:15,000
A17190	154	1960	1:25,000

Historical air photo analysis indicates that the channel has been laterally mobile within the reach of the proposed crossing. In the past 53 years, lateral channel adjustments were on the order of 200 m upstream and downstream of the proposed crossing, and approximately 50 m at the crossing, or 50% to 55% of the modern channel width.

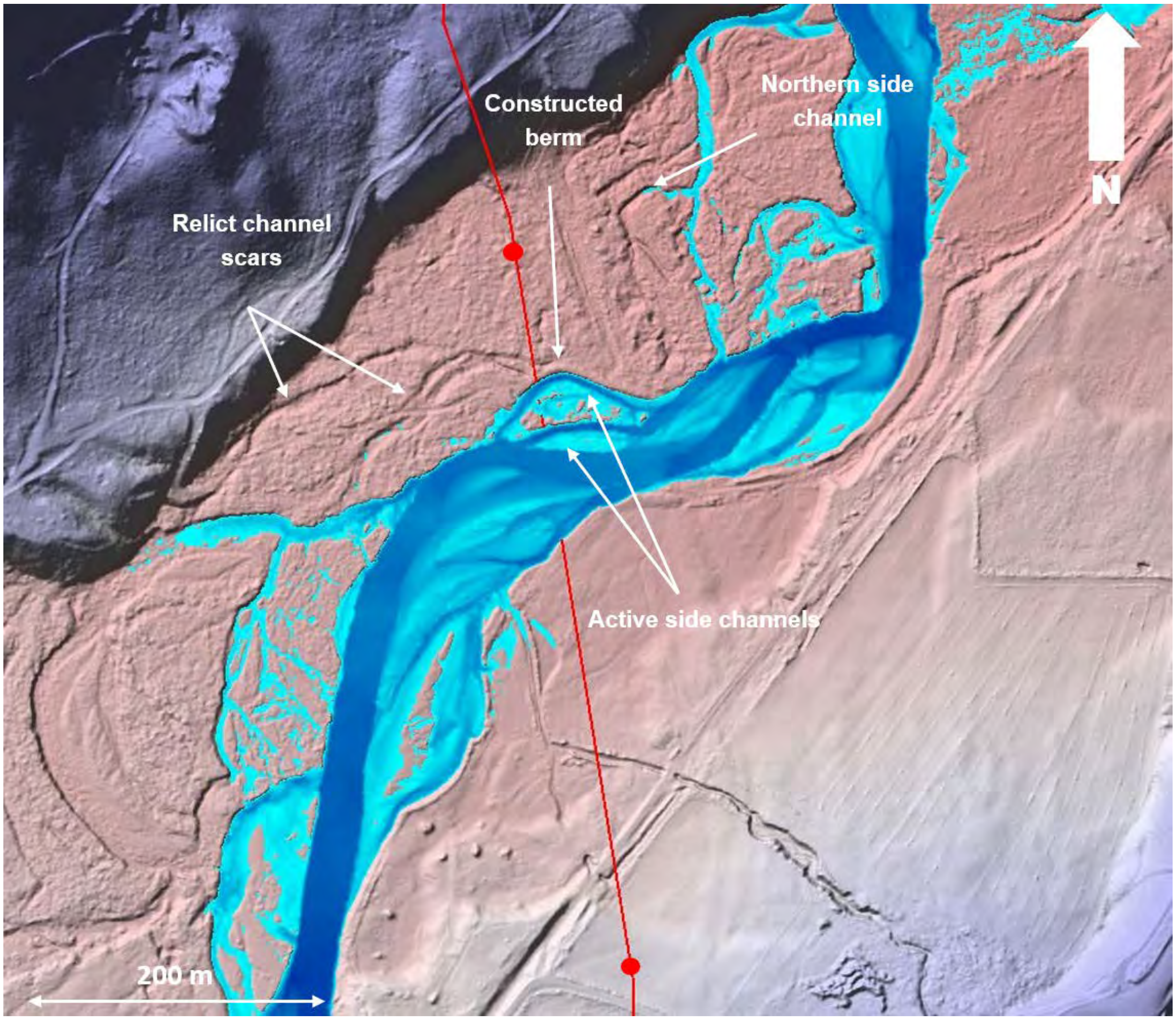


Figure 4-3. Simulated bankfull inundation. The proposed HDD entry and exit locations are marked with a red dot.

The proposed HDD entry point located within the left floodplain is set back approximately 80 m north of the north (left) bank of the main channel of the Coldwater River. The berm constructed along the north bank of the active side channel approximately 40 years ago appears to have been effective to date in confining most of the flow to the main channel and limiting migration of the main channel to the north (see Figure 4-3 above). Given the setback distance relative to the magnitude of historical lateral adjustments, and the presence of the berm, bank erosion during an individual flood event is not considered a hazard to the proposed HDD entry point at this time. However, progressive bank erosion in the future may ultimately outflank the berm, requiring proactive management, as discussed in Section 4.6.

As seen in the 1960, 1969 and 1981 air photos, the northern side channel may present an encroachment hazard to the proposed HDD entry point through erosion of its north (left) bank (see Figure 4-3 above). Review of the LiDAR dataset and recent air photos suggests that since construction of the berm, aggradation occurred at the inlet of the side channel, making flow through the side channel a rare event (>20-year flood). Moreover, simulated flow velocities were less than 1 m/s for floods up to the 200-year flood event, suggesting that erosion of the north (left) bank of the side channel is unlikely for floods ranging from the 20- to the 200-year flood events.

Bank erosion is not considered a hazard to the proposed HDD exit point given its location outside of the floodplain and its setback distance of approximately 300 m south of the south (right) bank.

4.6. Avulsion

Avulsion can occur during a flood event through formation of a new channel or re-occupation of an existing channel within the floodplain. As is characteristic of meandering rivers, historical and inactive channels and relict channel scars are present throughout the floodplain around the proposed crossing. Notably, there are several relict channel scars on the north (left) floodplain directly upstream of the proposed alignment, located 65 m and 90 m north of the left bank of the main channel (see Figure 4-3 above). Given the historical instability of the channel within the reach, re-activation of the relict channels or formation of a new channel in the left floodplain is possible. The former could occur during a large flood event while the latter is likely a gradual process developing over multiple years. With time, such avulsions or bank erosion could outflank the berm to the north and impact the proposed HDD entry point. Therefore, both bank erosion and avulsion are considered hazards to the HDD entry point over the lifetime of the pipeline. However, neither hazard is considered an immediate threat to the pipeline that could develop during an individual flood event. If the river was to encroach to the north in the future through either avulsion or bank erosion (or a combination thereof), both processes would develop over a number of years, allowing sufficient time for proactive implementation of engineered mitigation measures.

4.7. Summary of Hydrotechnical Hazard Assessment

The hydrotechnical hazard assessment of the Coldwater River at the Coldwater IR south crossing considered bank erosion, scour and avulsion potential. Scour is not considered a hazard to the proposed borepath due its depth below the main channel. Due to the lateral instability of the river and its multi-thread pattern, both bank erosion and avulsion are considered hazards to the HDD entry point over the lifetime of the project. However, neither hazard is considered an immediate threat to the pipeline that could develop during an individual flood event. Both processes would develop over a number of years, allowing sufficient time for proactive implementation of engineered mitigation measures.

5.0 SITE INVESTIGATION

BGC supervised the drilling of two boreholes (BH-BGC19-CW5-01 and BH-BGC19-CW5-03) on the south side of the Coldwater River from November 25 to 31, 2019. Two additional boreholes were completed on the north side of the Coldwater River from July 20 to 24, 2020. The borehole locations and their positions relative to the proposed drill path are summarized in Table 5-1 below and are illustrated on Drawing 03A (plan view) and 04 (plan and cross sectional views).

Table 5-1. Borehole summary table.

Borehole ID	Coordinates UTM NAD 83 Zone 10U		Location	Final Depth (mbgs)
	Easting (m)	Northing (m)		
BH-BGC19-CW5-01	648939	5539288	270 m southeast from south bank of Coldwater River, 50 m north of the proposed HDD exit	44.3 m
BH-BGC20-CW5-02	648848	5539625	40 m northwest from north bank of Coldwater River, 85 m south of the proposed HDD entry	50.0 m
BH-BGC19-CW5-03	648909	5539446	125 m southeast from south bank of Coldwater River, near the mid-point of the HDD borepath	42.7 m
BH-BGC20-CW5-04	648797	5539886	300 m northwest from north bank of Coldwater River, 175 m north northwest of the proposed HDD entry	20.3 m

The proposed HDD alignment is shown in Drawing 04 with the borehole locations and the geological interpretation of the section. Borehole logs are included as Appendix B.

Drawing 05 presents the results of the geophysical surveys. Drawings 06A and 06B contain site photographs of drilling activities during the 2019 and 2020 site investigations.

5.1. Geotechnical Drilling Data

Drilling was completed using a Fraste MDXL track mounted mud rotary drill. The boreholes were advanced with a 95 mm tricone bit with standard penetration tests (SPTs) at 1.5 m to 3 m intervals. Upon completion of drilling, all boreholes were grouted to surface with a cement-bentonite mix and bentonite chips to top up to surface elevation. No instrumentation was installed in any boreholes.

Data collected during investigative drilling included the following:

- SPT blow counts and visual description (according to Unified Soil Classification System) of soil units based on visual examination of material retrieved in the SPT sampler
- Moisture contents, grain size distributions, and Atterberg limits of selected samples, based on laboratory testing

- Rock core description according to ISRM standards and UCS (Uniaxial Compressive Strength) testing
- Depth to observed ground water as observed each day prior to the commencement of drilling.

Figures C-01 and C-02 in Appendix C provide the results from the grain size analysis, and Figure C-03 provides the results of Atterberg limits tests, respectively.

5.2. Groundwater Conditions

Prior to drilling each day, the groundwater level was measured with a water level meter. The water levels reported in Table 5-2 below may not be representative of static groundwater levels due to the use of drilling mud and unknown permeability of the formations. BH-BGC19-CW5-01 and -03 experienced fluid loss in coarser grained soils near the surface, which were inferred to be of fluvial origin. BH-BGC20-CW5-04 experienced fluid loss in a coarse-grained unit near the surface, which was inferred to be colluvium. Instrumentation was not installed to monitor the long-term static groundwater conditions.

Artesian groundwater conditions were encountered in BH-BGC19-CW5-03 in a gravel unit below 35 m depth. Artesian upwelling was observed when drill rods were removed, however, it did not pose a significant challenge during investigative drilling.

Table 5-2. Groundwater conditions summary by borehole.[2]

Borehole ID	Water Level Readings (mbgs)	Depth of fluid loss	Artesian Conditions
BH-BGC19-CW5-01	5.05 (Nov. 25, 2019) 4.45 (Nov. 26, 2019)	2.7 m (cased to 12 m)	None observed.
BH-BGC20-CW5-02	0.13 (July 21, 2020) 6.75 (July 22, 2020) 2.91 (July 23, 2020)	No loss observed	None observed
BH-BGC19-CW5-03	2.30 (Nov. 28, 2019)	6.5 m (cased to 9 m)	Artesian observed below 35.0 m depth
BH-BGC20-CW5-04	0.22 (July 24, 2020)	1.6 m (cased to 4 m)	None observed

5.3. Geophysical Survey

Advisian completed seismic refraction and electric resistivity tomography (ERT) geophysical surveys along the proposed HDD crossing between May 5 and May 7, 2020. The seismic survey was completed on the north bank of the Coldwater River to extrapolate the top of bedrock observed in the investigative borehole and at surface. The ERT survey was completed along the full length of the HDD alignment.

---

[2] Water level readings may be influenced by drilling fluid and may not reflect static groundwater level.

The seismic refraction survey suggests that the bedrock outcrop observed on the north side of the Coldwater River dips to the south, below the HDD borepath. The geotechnical drilling data from BH-BGC20-CW5-02 and -04 supports this interpretation.

ERT data supports the bedrock interpretation and provides insight on the contact between the course-grained sand and gravel unit and underlying primary fine-grained till unit. It also provides insight on the lateral extents of the coarse-grained gravel unit encountered in BH-BGC19-CW5-03. Advisian infers from geophysics results that coarse-grained gravel unit may be present at depth within the till unit and may intersect the HDD borepath.

Results from the geophysical surveys can be found in Drawing 05. The interpreted geophysical cross section completed by Advisian can be found in Appendix D.

6.0 INFERRED GEOTECHNICAL CONDITIONS ALONG HDD DRILL PATH

Based on the results of geotechnical drilling, BGC has developed a geological section of the proposed HDD crossing which is shown in Drawing 04. Below is a summary of soil properties and drilling conditions encountered within the primary units identified during the geotechnical investigation:

- SAND AND GRAVEL (Fluvial) – Low to Moderate (0% to 60%) drilling mud returns were generally experienced in this unit. Significant (1000 to 2000 L) loss of drilling fluid was experienced in boreholes BH-BGC19-CW5-01 and -03 on the south bank between 8 to 12 m depth. Representative SPT N-values ranged between 8 - 22, with three of twelve tests within this unit hitting refusal on inferred gravel.
- SILT (Fluvial Overbank) – High (80% to 90%) drilling mud returns were experienced while drilling through this unit. This unit was encountered in BH-BGC19-CW5-01 between 4 to 8 m. SPT N-values ranged from 4 to 5 indicating that it is soft to firm. Atterberg results in this unit indicated that the material was low plasticity.
- SILT AND SAND (Till) – High (80% to 90%) drilling mud returns were generally experienced in boreholes BH-BGC19-CW5-01, -02 and -03. The density of this unit was typically hard or very dense with most SPT N-values hitting refusal. Minor borehole instability was experienced when drilling though layers of predominantly sand and/or gravel.
- GRAVEL AND SAND (Glaciofluvial) – High (80% to 90%) drilling mud returns were experienced while drilling through this unit. This unit was encountered at 35 m depth in BH-BGC19-CW5-03 and was inferred to be glaciofluvial. Artesian groundwater conditions were noted in this unit. Most SPT N-values hit refusal. This unit had poor recovery and was inferred from drilling action and cutting returns between SPT samples.
- CLAY AND SILT (Glaciolacustrine) – High (80% to 90%) drilling mud returns were experienced while drilling through this unit. This unit was encountered in BH-BGC20-CW5-02 between 24 and 46 m depth. Most SPT N-values ranged between 20 to 28 (very stiff to hard). Atterberg results indicated this unit has high plasticity.
- GRAVEL (Colluvium) – Moderate (60% to 80%) drilling mud returns were experienced while drilling in this unit. This unit was encountered above 5 m in BH-BGC20-CW5-04 and was compact to very dense. Cobbles and boulders were inferred from drilling action.
- VOLCANIC BEDROCK (Spence's Bridge Group) – High (80% to 90%) drilling mud returns were experienced while drilling through this unit. BH-BGC20-CW5-02 encountered a rhyolitic rock type, while BH-BGC20-CW5-04 encountered an andesitic rock type. Both lithologies are intrusive volcanic in origin and are considered to be part of the same geologic group. The rhyolite encountered in BH-BGC20-CW5-02 yielded UCS test results between 38 MPa to 91 MPa and contained closely to widely spaced fractures. The andesite encountered in BH-BGC20-CW5-04 yielded UCS test results between 13 MPa to 111 MPa.

Table 6-1. Summary of geological units identified during BGC's geotechnical investigation.

Geological unit	Depth (mbgs)				Typical Soil Description	SPT Blow Count (N)	Relative Density	Fluid Circulation	Additional considerations
	BH-01	BH-02	BH-03	BH-04					
Sand and gravel (fluvial)	0 – 4.0 and 8.2 – 10.5	0.0 – 5.1	0 – 13.0	N/A	SAND and GRAVEL, trace silt, well graded, brown.	8 – R	Loose to very dense	0% to 60%	May contain cobbles and boulders, borepath instability, drill fluid loss.
Silt (fluvial overbank)	4.0 – 8.2	N/A	N/A	N/A	CLAY, silty low plasticity, greyish brown, wetter than plastic limit (WTPL), homogeneous	4 - 5	Soft to firm	80% to 90%	May experience steering challenges, low bearing capacity.
Gravel (colluvium)	N/A	N/A	N/A	0 – 5.1	GRAVEL, sandy, silty, well graded, angular to subangular, mottled grey, homogeneous.	19 - R	Compact to very dense.	60% to 80%	May contain cobbles and boulders.
Sand and silt (till)	8.2 – 44.3	5.1 – 24.5	13.0 – 35.0	5.1 – 6.6	SAND and SILT, trace gravel, subangular to subrounded, brownish grey, homogeneous.	43 – R (Most values hit refusal)	Dense to very dense	80% to 90%	May contain cobbles and boulders.
Gravel and sand (glaciofluvial)	N/A	N/A	35.0 – 42.7	N/A	GRAVEL, fine to coarse, sandy, well graded, angular, brown to black, wet	R	Very dense	80% to 90%	Borepath instability and artesian groundwater pressures.
Silt and clay (glaciolacustrine)	N/A	24.5 – 46.3	N/A	N/A	CLAY and SILT, some sand, low to high plasticity, grey, NPL	20 – 28	Stiff to hard	80% to 90%	
Bedrock (Spence's Bridge Group)	N/A	46.3 – 50.0	N/A	6.6 – 20.3	ANDESITIC VOLCANIC ROCK, slightly weathered to fresh, weak to very strong, closely to widely spaced fractures	N/A	N/A	80% to 90%	

6.1. Anticipated Conditions Along the HDD Borepath

At the HDD entry point, the borepath is anticipated to encounter fluvial deposits for 10 to 20 m along the borepath. These deposits are coarse grained, and some fluid loss was observed during geotechnical drilling. The borepath is then anticipated to enter a hard or very dense till with a predominantly silt matrix for approximately 200 m. While geotechnical drilling did not encounter any fluid losses in this unit, lenses of a sandy matrix within the till were observed. These sandy lenses were up to 11 m thick. At approximately 200 m along the borepath from the entry, the HDD borepath intersects an inferred glaciofluvial gravel and sand unit for an estimated 50 m length. This unit was observed during the drilling of BH-BGC19-CW5-03 and had artesian groundwater pressures. Geophysical surveys indicate that this unit appears in lenses at depth near the HDD invert and while it is not anticipated to connect to the surficial fluvial layer, the extent of the unit is unknown. The borepath is interpreted to then continue through the till until it reaches the fluvial unit over the final 10 to 20 m to the ground surface at the HDD exit. A lens of silty clay was encountered at BH-BGC19-CW5-01 within the fluvial unit but the lateral extent of this unit is unknown. The borepath is expected to exit within the fluvial unit.

7.0 GEOTECHNICAL FEASIBILITY ASSESSMENT

The following conclusions can be drawn from the regional surficial and bedrock geology, local hydrology and results of BGC's geotechnical drilling and Advisian's geophysical surveys completed along the proposed HDD crossing.

7.1. General Considerations

- The 200-year scour depth is estimated to be approximately 1 m below the channels assumed thalweg. The proposed HDD borepath passes about 25 m below the channel thalweg and is therefore expected to maintain adequate cover in the event of scour of the existing river channel during flooding.
- The HDD entry point on the north bank is located within a low-lying floodplain and hydrologic modelling indicates it may become inundated in a 10- or 20-year flooding event. The HDD exit point on the south bank is not likely to be inundated during a 200-year flooding event.
- The mobility of the river channel within its low-lying floodplain results in avulsion hazard threatening the HDD entry point and the conventional trenched pipe in the floodplain over the lifetime of the pipeline.

7.2. HDD Considerations

- Cobbles were inferred from drill action within the fluvial, glaciofluvial and till units in which the majority of the proposed HDD borepath resides. Although not inferred from investigative drilling, boulders may also be encountered. The presence of large clasts may result in borepath instability, steering challenges, jamming of reamers and possible damage to the product line during pull through.
- A gravel and sand unit was encountered below 35 m in BH-BGC19-CW5-03, which coincides with the approximate elevation of the HDD invert. Artesian groundwater pressure was encountered within this unit; however, it did not pose a significant challenge during investigative drilling. Artesian ground pressure may dilute drill mud during HDD drilling. The presence of this gravel layer may result in borepath instability challenges steering challenges, possible jamming of reamers and possible damage to the product line during pull through.
- Low to Moderate (0% to 60%) drilling mud returns were experienced in the fluvial sand and gravel unit encountered near surface (above 13 m depth). Significant (1000 to 2000 L) loss of drilling fluid was experienced in boreholes BH-BGC19-CW5-01 and -03 between 8 to 12 m depth. Loss of drilling fluids into this unit and possibly to surface may be experienced when advancing the drill through this layer, and should be addressed during detailed design and construction.
- **Error! Bookmark not defined.**Soft silt and clay was encountered in BH-BGC19-CW5-01 between 4 to 8 m depth near the HDD exit point. Due to their soft nature, these soils may present steering challenges for the HDD which should be accounted for during detailed design and construction.

- Sandy lenses in the till unit were noted in BH-BGC20-CW5-01 and may be present elsewhere along the borepath. Tills with a sandy matrix may present fluid loss and subsequent borepath stability issues for the HDD and should be addressed during detailed design and construction.
- Bedrock was encountered in BH-BGC20-CW-02 and BH-BGC20-CW5-04, however it is not expected to be encountered along the proposed HDD borepath.

7.3. Geotechnical Feasibility

Given the above, and based on the desktop study observations from geotechnical borehole, an HDD crossing at this location can be considered feasible from a geotechnical perspective provided the following concerns are addressed during detailed design and construction:

- Presence of cobbles or boulders. Cobbles were inferred from drill action within the fluvial, glaciofluvial and till units in which the majority of the proposed HDD borepath resides. Although not inferred from investigative drilling, boulders may also be encountered. The presence of large clasts may result in borepath instability, steering challenges, possible jamming of reamers and possible damage to the product line during pull through.
- Presence of gravel unit with artesian groundwater pressure. A gravel and sand unit was encountered below 35 m in BH-BGC19-CW5-03, which coincides with the approximate elevation of the HDD invert. Artesian groundwater pressure was encountered within this unit; however, it did not pose a significant challenge during investigative drilling. Artesian ground pressure may dilute drill mud during HDD drilling. Gravel layers and cobbles in this unit may result in borepath instability, steering challenges, possible jamming of reamers and possible damage to the product line during pull through.
- Potential for hydraulic fracturing and drill fluid loss. Low to Moderate (0% to 60%) drilling mud returns were experienced in the fluvial sand and gravel unit encountered near surface. This was observed between 8 to 12 m in the boreholes on the south banks on the river (BH-BGC20-CW5-01 and -02). Zones of drill fluid loss and poor circulation should be expected in the fluvial sand and gravel unit and the potential for hydraulic fracture and release to surface should be assessed by the HDD designer and contractor during detailed design and construction.
- Flood and avulsion hazard on the north bank. The HDD entry point north of Coldwater River is located within a low-lying floodplain and hydraulic modelling indicates it may become inundated in a 10- or 20-year flood event. The HDD entry point and the conventionally trenched pipe further north on the floodplain are also exposed to avulsion and bank erosion hazards over the lifetime of the project. Neither hazard is considered an immediate threat to the pipeline that could develop during an individual flood event. Both processes would develop over several years, allowing sufficient time for proactive implementation of engineered mitigation measures. Alternatively, a different profile could be considered extending beyond the floodplain to the north.

8.0 CLOSURE

We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

BGC ENGINEERING INC.
per:

Heather Hughes-Adams, EIT (BC) Geotechnical Engineer	Matt Thompson, P.Eng., GIT Geotechnical Engineer

Reviewed by:

Pete Quinn, Ph.D., ing., P.Eng. (BC, ON, AB, SK)
Principal Geotechnical Engineer

MT/PQ/gc/mm

REFERENCES

Bednarski, J.M. (2009). Surficial geology Clearwater Open File 6133. *Geological Survey of Canada*.

BGC Engineering Inc. (2020, January 31). *Geohazard Study for West Alternative Route Around Coldwater IR.* [Report]

Cui, Y., Miller, D., Schiarizza, P., and Diakow, L.J. (2017). *British Columbia Digital Geology*. Open File 2017-8, 9p. British Columbia Ministry of Energy, Mines and Petroleum Resources, British Columbia Geological Survey.

Dahlin, T. (1996). *2D Resistivity Surveying for Environmental and Engineering Applications*, Vol. 14, No. 7.

Engineers and Geoscientists British Columbia. (2018). Professional practice guidelines: Legislated flood assessments in a changing climate in BC version 2.1. *Retrieved from https://www.egbc.ca/getmedia/f5c2d7e9-26ad-4cb3-b528-940b3aaa9069/Legislated-Flood-Assessments-in-BC.pdf*

Fulton, R.J. (1975). Surficial geology Merritt CGS Open File 1393A. *Geological Survey of Canada*.

Fulton, R.J. (1976). Surficial geology Kamloops Lake GSC Open File 1394A. *Geological Survey of Canada*.

Fulton, R.J. and Smith, G.W. (1978). Late Pleistocene stratigraphy of South-Central British Columbia. *Canadian Journal of Earth Sciences*, 15: 971-980

Journeay, J.M., Williams, S.P., and Wheeler, J.O. (2000). Tectonic assemblage map, Vancouver, British Columbia GSC Open File 2948a. *Geological Survey of Canada*.

Palacky, G.J. (1987). Resistivity Characteristics of Geologic Targets, *Society of Exploration Geophysics*, v. 1.

Ryder, J.M., Fulton, R.J., and Clague, J.J. (1991). The cordilleran ice sheet and the glacial geomorphology of Southern and Central British Columbia. *Geographie physique et Quaternaire*, 45: 365-377.

Tipper, H.W. (1970). Surficial geology Bonaparte Lake Open File 1293A. *Geological Survey of Canada.*

Trans Mountain Pipeline ULC. (2014). Trans Mountain Expansion Project Application to the National Energy Board. *Terrain Mapping and Geohazard Inventory - Revision 1*, filed as part of NEB Technical Update #1, August 1, 2014.

US Army Corps of Engineers (USACE) (2010). *HEC-RAS User's Manual*, Version 4.1, January.

APPENDIX A
HYDROTECHNICAL INVESTIGATION AND ANALYSIS METHODOLOGY

A.1. INTRODUCTION

This appendix documents the methodology followed by BGC Engineering Inc. (BGC) to complete hydrotechnical assessments at pipeline watercourse crossings. A description of hydrotechnical hazards is provided in Section A.2, followed by the flood frequency analysis (FFA) methodology in Section A.3. The hydrotechnical assessment methods specific to each hydrotechnical hazard are presented in Sections A.4 (scour), A.5 (bank erosion and encroachment), and A.6 (avulsion).

Several industry terminology conventions are used in this methodology report, and in supporting hydrotechnical reports. Definitions of the terminology are as follows:

Downstream	Direction of water flow.
Upstream	Direction opposite to water flow.
Right & left banks	Reference convention for banks when facing downstream.
DoC	Depth of cover (burial depth) over the pipeline.
RoW	Pipeline right of way.
Thalweg	Line defining the lowest points along the length of a river bed or valley.
Hazards	Characterisation of hydrotechnical processes such as scour, channel bed degradation, and bank erosion that could result in a loss of DoC.
Likelihood	Qualitative assessment of how often an event may occur (e.g., the likelihood of scour hazard occurring is high).
Probability	Quantitative assessment of how often an event may occur (e.g., the probability of scour hazard occurring is 0.05 yr^{-1}).
Return Period	The inverse of probability, it gives the estimated average time interval between events of a similar intensity (e.g., 1/[0.05 yr^{-1}] = 20 yr return period).

A.2. HYDROTECHNICAL HAZARDS

The following hydrotechnical hazards are included as part of the hydrotechnical assessment:

- Scour of the channel bed;
- Bank erosion caused by lateral channel migration or channel widening;
- Encroachment of the channel towards the pipeline due to bank erosion; and
- Avulsion of the channel within the floodplain.

A.2.1. Scour

Scour is the localized removal of granular bed material from the channel substrate by hydrodynamic forces during a flood event. Scour can happen at any location where local flow velocities increase within an otherwise uniform flow situation. Scour also occurs when the direction of flow changes at channel bends, confluences, constrictions, obstructions, and impingements. There are two types of scour: general scour and local scour.

General scour occurs due to the complex interaction between flow rates and volumes, sediment transport rates, and channel morphology. Intermittent general scour occurs when a mobile-bed watercourse floods and the channel bed degrades (lowers) to accommodate the increased flow. Pipelines can become exposed or undermined during an intermittent flood event, becoming vulnerable to damage. The channel bed can experience significant scour during a flood event but this is often not detected because of compensating deposition that can occur as the flood flows decline (Leopold et al. 1964).

Local scour results from acceleration of flow due to an obstruction or constriction to flow near piers, abutments, riprap revetments, large woody debris or other structures obstructing or constricting the flow. These obstructions cause vortices with accelerated flow that erode the surrounding bed and bank sediments. Contraction scour is a form of local scour where acceleration of flow is caused by a local narrowing of the channel.

Local and general scour depths are shown in the schematic in Figure A-1. General scour depth is measured relative to the design flood water level and local scour depth is measured from the bottom of the general scour elevation. Both general and local scour contribute to the total scour depth below the design flood water level.

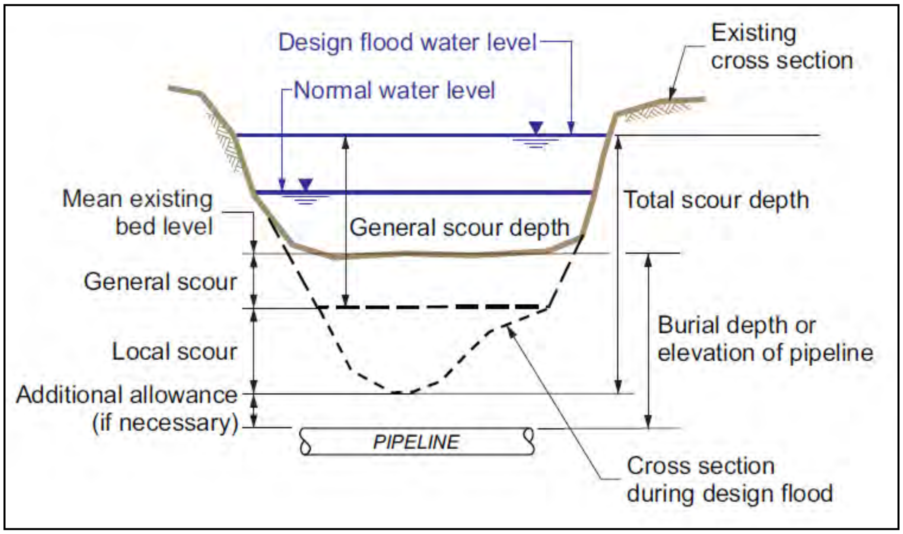


Figure A-1. Schematic of general and local scour (reproduced from Veldman 2008).

A.2.2. Bank Erosion and Encroachment

Patterns of sediment transport and deposition naturally cause the channel banks to migrate laterally, resulting in bank erosion. Erosion can take place slowly over a period of years or suddenly during a single flood event. Gradual bank erosion most often occurs on outer bends of low gradient, meandering river channels. Large flood events may cause sudden widening, particularly in braided or wandering rivers, as the channel geometry adjusts to convey the additional flow. Bank migration (erosion) at a pipeline crossing, either through lateral migration or episodic widening, can result in exposure of the sagbends and overbends of the pipeline.

Encroachment may be a hazard to the pipeline where bank erosion is occurring along a section of the channel that flows parallel and adjacent to the pipeline RoW. Bank erosion can lead to lateral movement of the watercourse toward the pipeline, potentially leading to exposure and freespan of a section of the pipeline outside of a designed watercourse crossing.

A.2.3. Avulsion

Avulsion, also referred to as outflanking or abandonment, occurs when streams leave their present channel and establish a new channel. This process can lead to pipe exposure if the new channel intersects the pipeline outside of the designed watercourse crossing where the top of pipe elevation may be higher. Avulsion frequently takes place on alluvial fans that carry high loads of bed material. It may also occur where rivers meander on a wide floodplain, although in this case the avulsion is typically into an existing side channel or abandoned channel. For the latter scenario, avulsion typically occurs progressively over a period of years rather than suddenly during a large flood event (although the large flood event may be the final tipping point for the avulsion to occur).

In braided channels, the term avulsion is sometimes used to describe a shift in the main thread of current to the other side of a mid-channel bar, but in general, is intended to denote a complete shift of the main channel. Avulsions commonly result when an event (usually a flood) of sufficient magnitude occurs along a reach of river that is at or near an avulsion threshold (Schumm 2005).

Avulsion channels can be characterized as active, transitional, or inactive based on the hydrological regime. Active avulsions are characterized by the presence of standing or flowing water. Transitional avulsions are dry without established vegetation. Inactive avulsions are dry and vegetated in the channel suggesting conditions have remained constant for several years.

A.3. FLOOD FREQUENCY ANALYSIS

Flood discharge magnitudes and frequencies are estimated using a flood frequency analysis (FFA). Flood discharge quantiles are estimated for one or several representative hydrometric gauge stations, which are then related to the pipeline crossing using a site-specific relationship to estimate flood discharge quantiles at the crossing. This relationship could be a proration using a station on the same watercourse or a regression using several representative stations near the crossing. The flood discharge quantiles estimated using an FFA form the basis for the hydrotechnical hazard assessment for scour, bank erosion, encroachment, and avulsion. The methods used to conduct an FFA are described herein.

The FFA is based on an approach known as Annual Maximum Series (AMS), which uses the maximum discharge value over a period of time. The selected AMS is the maximum peak instantaneous streamflow for each year on record, which is assumed to be a random sample from the underlying population of hydrological events and can thus be estimated by the selection of an appropriate statistical distribution.

Extreme value statistics are used to estimate flood discharge quantiles from the AMS. A distribution known as the Generalized Extreme Value (GEV) distribution, which is described by location, scale, and shape parameters, is fitted to the AMS to estimate the flood discharges associated with selected event probabilities (Gilleland and Katz 2006). This statistical analysis is conducted using the Extremes package in R, a non-proprietary software environment for statistical computing and graphics (Gilleland 2016).

A.3.1. Historical Peak Flow Records

The FFA requires the input of streamflow data. In Canada, the Water Survey of Canada (WSC) monitors and manages hydrometric stations and publishes their data. The hydrometric stations for FFA are selected based on proximity to the crossing, available streamflow data (i.e., record length), drainage basin area, station elevation, hydro-climatic zone, and regulation type.

The preferred input to the FFA is peak instantaneous streamflow (Q_{IMAX}) for each available year on record. However, peak streamflow records at hydrometric stations are often limited to maximum average daily streamflow (Q_{MAX}) which are lower in magnitude than Q_{IMAX}. The difference between peak instantaneous and average daily flows are typically greater for small basins than for very large drainage areas. In some cases, Q_{IMAX} values may be estimated from available Q_{MAX} records using regression analyses techniques.

A.3.2. Prediction Limit of Dataset

The maximum return period for which a peak streamflow can be estimated reliably (i.e., the prediction limit) at a given hydrometric station is limited by the record length of the dataset defined by the number of years with a complete peak streamflow record. Generally, in cases where the record length of the station of interest is too short, the dataset can sometimes be extended using a correlation analysis with another nearby hydrometric station to estimate flood frequencies of higher return periods.

A.3.3. Climate Change

Flood frequency analyses use extreme value statistics that rely on assumptions of stationarity and homogeneity in the hydrologic data; however, climate change may invalidate the assumption of stationarity by producing a temporal trend in flood magnitude over time. Flood magnitude may be directly influenced by changes in annual precipitation or intensity, but is also indirectly affected by changes in precipitation phase related to temperature fluctuations (e.g., greater frequency of rain-on-snow events). The assumption of homogeneity in flow records will also be invalidated in many regions, as hydrologic regimes may shift from snowmelt-dominated or hybrid to rainfall-dominated, creating mixed populations of data.

The impacts of climate change on hydrology are expected to vary regionally based on differences in temperature and precipitation changes across Canada. Potential impacts are described in the following sub-sections for select regions according to Canadian Ecozones (i.e., broad ecological units) (Li and Hélie 2014), as shown in Figure A-2. These regions were selected to capture the geographic range of hydrotechnical assessments for the Trans Mountain Expansion Project.

The magnitude and timing of climate change impacts on hydrology in these different regions are uncertain. It is expected that some areas will experience more frequent, high-intensity flood events while others will experience less frequent flood events of the same intensity. These descriptions are intended to serve as general information only. Statistical analyses have not been incorporated in the FFAs to account for regional climate change impacts on hydrology at this time. Instead, flood quantiles for sites in all ecozones are conservatively increased by 10% to account for this uncertainty.

Figure A-2. Geographic map of Canadian ecozones across the geographic range of the Trans Mountain Expansion Project.

A.3.3.1. Pacific Maritime

The dominant form of precipitation dictates runoff patterns throughout much of Canada (Whitfield 2001). Thus, although changes in the annual volume of precipitation due to climate change are uncertain (e.g., Zwiers et al. 2011), much of the Pacific Maritime region will experience changes in runoff timing as a result of increased winter temperature, as the contribution of snowmelt to annual runoff decreases. As a result, many streams in the Pacific Maritime region will shift from nival (i.e., snowmelt-dominated) to hybrid regimes, which are characterized by earlier snowmelt and more frequent rain-on-snow events (Loukas and Quick 1999; Whitfield 2001). Meanwhile hybrid streams are anticipated to transition to a fully pluvial regime, as the importance of the spring freshet decreases due to a loss of winter snowpack, especially in coastal areas (Zwiers et al. 2011; Schnorbus et al. 2014). As nival watersheds trap precipitation from winter storms in the snowpack, releasing it gradually during the spring freshet, this transition may be accompanied by an increase in the size and variability of floods (Pitlick 1994). To date, the impacts appear to be greatest in headwater streams; the Columbia River, for example, has shown little change in runoff magnitude or timing (Hatcher and Jones 2013), though this resilience is in part due to an increase in snowpack at high elevations (Schnorbus et al. 2014).

A.3.3.2. Semi-Arid Plateaux

A decrease in the number and magnitude of flood events is predicted for many snowfall-dominated watersheds, particularly in the semi-arid interior regions of British Columbia (Loukas et al. 2002). In drier climates, evaporation from water surfaces and from the land as well as transpiration from vegetation make up a large component of the regional water balance suggesting that temperature changes have the potential to affect runoff. Trends suggest that the Okanagan Basin is getting warmer and wetter with minimum temperatures and the number of frost-free days increasing (Cohen and Kulkarni 2001). Climate change scenarios predict an increase in winter temperature of 1.5 to 4.0 ºC and an increase in summer temperatures by approximately 2 to 4 ºC by the 2050s compared to the 1961 to 1990 baseline (Merritt et al. 2006).

Taylor and Barton (2004) analyzed precipitation records from six sites in the Okanagan Basin and identified statistically significant positive trends in spring-time and summer precipitation for most stations. In contrast, climate change scenarios show precipitation increases on the order of 5 to 20% during the winter season and more variable predictions in the summer with changes ranging from no change to a 35% decrease by the 2050s compared to the 1961to1990 baseline, depending on the Global Climate Model and emission scenario (Merritt et al. 2006). Despite the warmer and wetter climate, little impact on the total water supply has been observed to date, which likely reflects a cancellation of the increase in precipitation inputs versus evapotranspiraton losses (Fleming and Barton 2015). Most studies seem to agree that climate change is resulting in an earlier onset of the spring freshet, a more rainfall-dominated hydrograph, and reduction in the annual and spring flow volumes with large variation in the flow volume and magnitude of the timing shift (Cohen and Kulkarni 2001; Merritt et al. 2006; Fleming and Barton 2015).

A.3.3.3. Montane Cordillera

Extreme flooding in the Montane Cordillera is often associated with rain-on-snow events during the spring freshet (Harder et al. 2015). Although the effects of climate change on precipitation are not clear in this region, projected increases in temperature are expected to have the largest impact on annual minimum temperatures occurring in the winter months (Harder et al. 2015). As a result, the temperature rise will dramatically impact the ratio of rainfall to snowfall throughout the winter and spring, leading to a decrease in snowpack accumulation and changes in melt timing (Farjan et al. 2016). Researchers anticipate that streamflow will increase in the winter and spring in this region due to earlier snowmelt and more frequent rain-on-snow events (Schnorbus et al. 2014; Farjan et al. 2016).

The effects of temperature change differ throughout the region, however, based on watershed elevation; high elevation regions throughout parts of the Montane Cordillera are projected to experience increases in snowpack, which would limit changes to peak flow in high elevation basins (Loukas and Quick 1999). To date, the sustained snowpack accumulation in some watersheds has limited changes in peak flows from climate change (Schnorbus et al. 2014, Harder et al. 2015). For example, Whitfield and Pomeroy (2016) recently studied the historical flow record for the upper Bow River, which contains over 100 years of records, and found that when flood events generated by different processes (snowmelt versus rain-on-snow) are analyzed separately, there are no clear trends in flood magnitude associated with climate index. The continued resilience of high elevation watersheds to future change is uncertain, though, as climate change is anticipated to affect snowpack accumulation at increasingly higher elevation regions throughout the century (Schnorbus et al. 2014, Harder et al. 2015).

A.3.3.4. Boreal Plains

Global Circulation Model predictions are in general agreement that the climate in the southern boreal forest will likely become warmer and drier in the future, especially in the summer due to greater water loss by evapotranspiration (Cubasch et al. 2001; Gregory et al. 1997). Regional climate models indicate that the predicted warming could increase evaporation by up to 55% in certain areas of Alberta, Saskatchewan, and Manitoba (Schindler and Donahue 2006). Paleolimnological studies have shown a drying trend with reduced flood frequency and intensity in the northern Boreal Plains since 1850 (Wolfe et al. 2006).

In contrast to temperature, precipitation trends are weaker and less certain. None of the data from reference climate stations within the Boreal Plains show significant trends in total precipitation over the time period 1950 to 2010 (Ireson et al. 2015). Data from some stations show a decline in annual snowfall and consequently a reduction in the fraction of precipitation that falls as snow due to the shortening cold season (Mekis and Vincent 2011). The response of hydrological processes to winter warming is highly uncertain. Earlier spring snowmelt and delayed autumn snowfall are predicted to be very likely but the impacts are not clear due to the complex runoff generation mechanisms in the Boreal Plains. For example, earlier melt could mean a shift to an earlier peak in streamflow and less water available in the late summer or it could mean more soil infiltration due to the increased proportion of rainfall over snowmelt which could increase soil moisture, stream baseflow, and hydraulic connectivity between wetland and streams (Barnett et al. 2005). Nevertheless, the net effect will be warmer and drier over time due to an increase in air temperature (Ireson et al. 2015).

A.3.3.5. Prairies

Peak runoff in the Canadian Prairies is primarily a result of spring snowmelt over frozen soils but can also be caused by intense rainfall from summer storms (Shook and Pomeroy 2012). The fraction of spring snowmelt forming runoff is strongly influenced by the rate of melt and the presence of ice layers near the surface in frozen soils or at the base of the snowpack, all of which can be influenced by rainfall in the spring and late fall. In 2008, earlier occurrence of spring runoff and decreasing trends in the spring snowmelt runoff volume, magnitude of peak flow, and summer baseflows were attributed to a combination of a reduction in snowfall and increases in temperatures during the winter months (Burn et al. 2008).

More recently, the fraction of monthly precipitation falling as rain was found to increase at many locations in the Canadian Prairies over the periods 1901 to 2000 and 1951 to 2000 (Shook and Pomeroy 2012). Short-duration summer convective rainfall events show significant decreases in frequency while multiple-day rainfall events have significantly increased in frequency at many locations in the Canadian Prairies over these time periods. Longer rainfall events strongly suggest greater spatial extents for storms and increasing tendencies for basin-scale rainfall–runoff events (Shook and Pomeroy 2012). Warming air temperatures, increased rainfall fraction in peak flows, earlier snowmelt, and higher occurrence of multiple-day rainfall events have, along with extensive wetland drainage (and corresponding reduction in runoff storage within basins), have resulted in an increase in flows generated from snowmelt, rain-on-snow, and rainfall runoff processes, with the greatest increases for rainfall runoff and a relative decline in the proportion of streamflow derived from snowmelt from over 85% in the 20th century to less than 50% in the last 5 years (Dumanski et al. 2015).

A.3.4. Pro-rated FFA

In cases where a single representative station is located along the same watercourse as the proposed pipeline crossing, a pro-rated FFA can be conducted by transposing the flood quantiles from the station to the crossing. This type of FFA uses a pro-rated calculation to relate the Q_{IMAX} quantiles at the hydrometric station to the pipeline crossing based on basin area. The equation used for this relation is as follows (Eq. A-1):

$$\frac{Q_U}{Q_G} = \left(\frac{A_U}{A_G} \right)^n \qquad \text{[Eq. A-1]}$$

where Q_U and Q_G are the peak instantaneous flow estimates (m^3/s) at the ungauged site (pipeline crossing) and gauged site (hydrometric station) respectively, A_U and A_G are the drainage basin areas (km^2) for the ungauged and gauged sites respectively, and n is a site-specific exponent that relates peak streamflow data at both sites (Transportation Association of Canada [TAC] 2004). The value of *n* is selected based on the drainage area, as shown in Table A-1. The drainage area at the pipeline crossing is typically estimated by BGC using available topographic datasets while drainage areas for the hydrometric stations are obtained from WSC records.

Table A-1. Approximate drainage area exponents for prorating flood quantiles (from TAC 2004)

Drainage Area (km^2)	Exponent, n
10 to 100	0.8
100 to 1000	0.65

1000 to 10,000	0.5
10,000 to 100,000	0.35
100,000 to 1,000,000	0.2

A.3.5. Regional FFA

A regional FFA approach is used to estimate design flood flows at the proposed pipeline crossing when there are several representative hydrometric stations in the area, either along the crossing watercourse or on nearby watercourses with similar catchment characteristics. A regional FFA is conducted using regression analysis, where Q_{IMAX} quantiles are estimated from a regression with the form of a power law, which is described by equation (Eq. A-2):

$$Q_p = aA^b \qquad \text{[Eq. A-2]}$$

where Q_p is the peak flood estimate at the pipeline crossing, A is the upstream drainage area for the crossing, and a and b are regression coefficients developed from the estimated Q_{IMAX} and calculated drainage area of several regional hydrometric stations (TAC 2004).

A.4. SCOUR ANALYSIS

Scour is the localized removal of granular bed material from the channel substrate by hydrodynamic forces during a flood event. The likelihood of a pipeline becoming exposed due to scour in a flood event is assessed by estimating the maximum scour depth associated with a range of return period floods. If the pipe's crown elevation within the bankfull channel is higher than the estimated scour elevation, then the pipe is considered to be susceptible to exposure for that particular magnitude of flood event. The scour elevation is estimated by subtracting the predicted scour depth from the design flood elevation, which is generated using an estimate of channel hydraulics with Manning's equation.

A.4.1. Channel Hydraulics

As part of the scour assessment, hydraulic parameters (i.e., water surface elevation, average flow depth etc.) are estimated at the pipeline crossing site for the design flood. The hydraulics are assessed by modeling flow through the study reach, or by applying Manning's equation at the pipeline crossing. Manning's equation is an empirical formula for open channel flow, and it is applicable in cases where flow is driven by gravity and is considered uniform. Manning's equation is defined in equation A-3.

$$V = \frac{1}{n} {R_h}^{2/3} \cdot S^{1/2} \qquad \text{[Eq. A-3]}$$

where V is the cross-sectional average velocity (m/s), n is Manning's roughness coefficient (unitless), R_h is the hydraulic radius (m), and S is the slope of the water surface (m/m). The hydraulic radius, R_h, is calculated as the cross-sectional area of the flow divided by the wetted perimeter. The slope of the water surface is generally assumed to be comparable to the regional slope of the channel bed for uniform flow. Manning's coefficient values typically range from 0.025 to 0.07 for streams with boulder to sand substrates; selection of an appropriate value is based on professional judgment.

A.4.2. General Scour Equations

Various empirical hydraulic equations have been developed to estimate general scour depth during a peak flow event (Table A-2). The selection and use of these equations requires engineering judgment, resulting in semi-quantitative results. Each method was designed by its authors based on a specific range of boundary conditions, and care must be taken to select appropriate methods for the site under study.

Table A-2. Methods for estimating the potential depth of general scour.

Method	Reference
Lacey's Regime	Lacey (1930)
Blench Regime	Blench (1969)
Yaremko and Cooper	Yaremko and Cooper (1983)

A.4.2.1. Lacey's Regime

Most of the work on general scour can be traced back to the concept of channel regime, starting with Lacey in 1930. The regime concept is generally considered synonymous with that of equilibrium or balance, and was a concept that originated with British engineers working in India from the study of the dimensions of stable alluvial, irrigation canals. The regime concept was originally formalized by Lindley (1919) who noted that "when an artificial channel is used to convey silty water, both bed and banks scour or fill, changing depth, gradient, and width, until a state of balance is attained at which the channel is said to be in regime."

Lacey (1930) expanded on the regime concept of Lindley by quantifying it. He defined a regime channel as a channel carrying a constant discharge under uniform flow in an unlimited incoherent alluvium having the same characteristics as that transported without changing the bottom slope, shape, or size of the cross-section over a period of time. Using data from irrigation canals on the Indian subcontinent, Lacey developed equations that related hydraulic parameters – namely wetted perimeter, velocity, hydraulic radius, and channel slope – to discharge and a silt factor (f), which takes into consideration the effect of sediment size on the channel dimensions. Lacey's regime equation for mean depth is shown in Equation A-4.

$$d_m = 0.47\left(\frac{Q}{f}\right)^{1/3} \qquad \text{[Eq. A-4]}$$

where:

- d_m is the mean hydraulic depth of the main channel at the design discharge (m)
- Q is the design discharge (m^3/s)
- f is Lacey's silt factor = 1.76 $(D_{50})^{1/2}$, (s^{-1})
- And D_{50} is the median bed particle size (mm).

The regime method of Lacey is limited to channels with a sand[1] bed, similar to conditions observed at the irrigation canals. However, Lacey also stated he was "inclined to believe that his formulas were general for all channels in the alluvium with which the engineer may be called upon to deal." While the equation was developed from canal data, it has since been checked against data from a number of stable bridge sites on large sand-bed rivers, with remarkably good agreement (Neill 1964).

The silt factor was introduced to account for differences in velocity-depth relations between different canal systems and was initially assumed to be a function of the grain size of transported sediment. For standard "silt" (actually medium sand) of 0.4 mm, the silt factor was taken as 1.

The above equation only gives an estimated mean depth across the channel. To estimate the maximum general scour depth for a given flow, a multiplying factor must be applied. Lacey (1930) stated that "in a river flowing through a stable reach the maximum depth should approximate to the mean depth multiplied by 1.273 (elliptical section). For moderate, severe and right-angled bends, he recommended replacing the multiplier by 1.5, 1.75, and 2.0 m (the last based on a triangular section), respectively. However, Lacey (1930) gave no numerical guidance as to sharpness of curvature. Table A-3 gives coefficients (Z_f factors) recommended by the Indian bridge code (1966), which are based mainly on consideration of the local channel morphology.

Table A-3. Empirical Lacey Z factors for maximum scour depth (after Neill 1973).

Channel Morphology	Correction Factor (Z_f Factor)
Straight reach	1.25
Moderate bend	1.5
Severe bend	1.75
Right-angled abrupt turn	2.0
Noses of piers	2.0
Alongside cliffs and weirs	2.25
Noses of guide banks	2.75

The resulting equation is then:

$$d_s = Z_f d_m \quad \text{[Eq. A-5]}$$

---

[1] The term "silt" was used at that time in India for canal sediment (Neill 1964).

where d_s is the scour depth below the channel bed (m) and Z_f is the correction factor (Table A-3). The average depth, d_m (m), is assumed to be the hydraulic depth over the incised portion of the channel. It is further noted that the above equations are based on an unconstrained river, where the width is not constricted or imposed. As an example, if the mean channel depth for a given flow is estimated by Equation A-4 to be 2.0 m and the site is at a moderate bend, then the maximum scour depth estimated using Equation A.5 would be 1.5 times the mean depth, or 3.0 m, as measured from the water level for the given flow. Most subsequent regime equations for estimating general scour are variants of Lacey's equations.

A.4.2.2. Blench Regime Depth

Blench (1969) extended previous regime methods to include cases of different bank material. With this method, the bed factor is similar to Lacey's silt factor. Blench defined the regime depth as follows:

$$d_r = q^{2/3}/F_b^{1/3} \qquad \text{[Eq. A-6]}$$

Where d_r = regime depth (m)

q = Q/b = unit discharge (m^3/s/m)

Q = design discharge (m^3/s)

b = water surface width (m)

F_b = F_{bo} (1 + 0.12 C) = bed factor (m/s^2)

F_{bo}= zero bed factor (m/s^2)

C = bed load charge.

The value of F_{bo} is the larger of the values determined from Equation A-7, which has been converted by BGC to metric units, or from Figure A-3:

$$F_{bo} = 14.63\ (D_{50}/d_r)^{0.5} \qquad \text{[Eq. A-7]}$$

where D_{50} = median diameter of bed material (m).

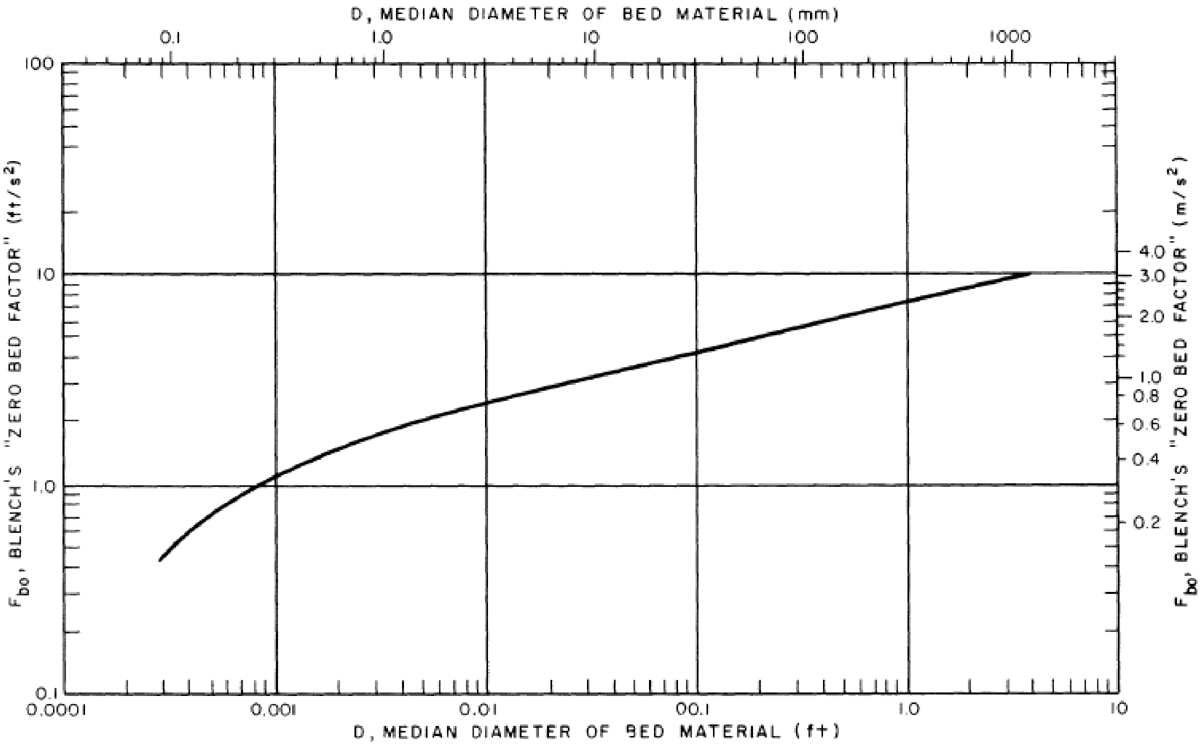


Figure A-3. Blench's zero bed factor, F_{bo}, versus particle diameter, D_{50}, from Pemberton and Lara (1984).

F_{bo} is the zero bed factor, or the value to which the bed factor tends as *C* tends to zero. Because the value of F_{bo} is calculated using the regime depth, solving the equation is an iterative process. The estimated bed load charge, C, is essentially an adjustment factor to dampen estimated scour depths when significant bed load transport occurs; under these conditions a portion of the stream's energy is committed to sediment transport rather than to scour of the channel bed. BGC's does not generally adjust for bed load charge as this leads to less conservative results.

Finally, similar to Lacey's method, the regime depth is multiplied by a Z factor to calculate the scour depth as per Equation A-8:

$$d_s = Z_f d_r \quad \text{[Eq. A-8]}$$

where d_s is the scour depth relative to the design flood stage (m), Z_f is the empirical correction factor, and d_r is Blench's regime depth (m). Northwest Hydraulic Consultants Ltd. (NHC) (1973) investigated Z_f factors to be applied to the Blench regime equation using both field and model results, and recommended the values shown in Table A-4.

Table A-4. Z_f factors for scour depth applied to Blench's regime equation (after NHC 1973).

Channel Morphology	Correction Factor (Z_f factor)
Forced, Rigid Bends	1.4 – 2.5
Free, Eroding Bends	1.4 – 1.75
Confluence	1.5 – 2.0
Tip of Spurs	2.0 – 2.75
Braided Channel[1]	2.5 – 3.0

Note:

1. Applicable to the bankfull mean depth of the largest existing channel in the vicinity of the crossing.

There is considerable range in Z_f factors for a given channel morphology, and NHC noted that selection of appropriate Z_f factors requires considerable experience in river engineering design. A conservative Z_f factor at the upper end of the range is typically selected to account for uncertainty in the scour analysis inputs and empirical methods.

A.4.2.3. Yaremko and Cooper

Yaremko and Cooper's (1983) scour equation assumes that scour depth is proportional to the mean channel depth for a given flow event. Essentially, the Yaremko and Cooper equation is a simplification of other regime equations, with the assumption that the mean depth is an approximation of the regime depth (Figure A-4). The mean channel depth is assumed to be the hydraulic depth (wetted area/top width). The Yaremko and Cooper scour equation is defined by equation A-9.

$$d_s = Z_f d_r \qquad \text{[Eq. A-9]}$$

where d_s is the depth of maximum scour relative to the design flood stage (m), d_r is defined as the hydraulic depth over the main (incised) portion of the channel, and Z_f is the correction factor. For appropriate Z_f factors, the authors quote the values shown in both Table A-3 and Table A-4.

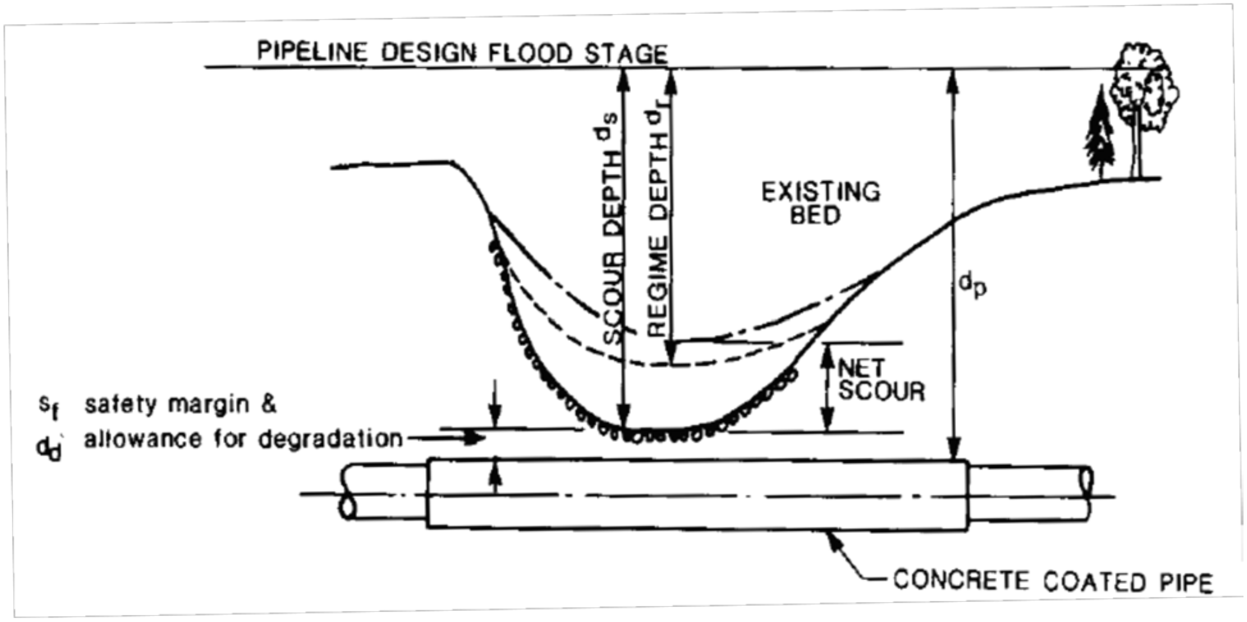


Figure A-4. Application of estimated scour depths relative to the design flood stage (after Yaremko and Cooper 1983).

Yaremko and Cooper (1983) note that on northern pipeline projects, a great deal of attention was focused on the importance of accurately estimating an appropriate design discharge for use in determining depth of scour. However, the authors note that the design procedure for estimating scour is much more sensitive to the selection of an appropriate Z factor, than it is to the accurate determination of a design flood discharge.

A.4.2.4. BGC Z Factors

As a general rule, BGC uses the Z factors specified in Table A-3 and Table A-4. An atypical example might be a braided river, where a local multiplier of 3 is used to account for increased scour at confluences, which are characteristic features of such rivers due to multiple channels and mid-channel bars. The mid-channel bars add geomorphic complexity that results in convergent flow downstream of these deposits, which can cause localized changes in bed planform, including scour holes (Ashworth 1996). Galay et al. (1987) indicate that scour multipliers for braided rivers can be as high as 5 under certain circumstances.

A.4.3. Maximum Bed Mobility

Channel bed mobility controls the adjustment of alluvial river channels and is driven by scour and entrainment. The maximum mobile particle size is estimated based on a combination of the shear velocity (u*) and channel bed shear stress (τ_b), which are calculated using Equations A-10 and A-11, respectively.

$$u^* = (gRS)^{1/2} \qquad \text{[Eq. A-10]}$$

$$\tau_b = g\rho RS \qquad \text{[Eq. A-11]}$$

where g is acceleration due to gravity (9.81 m/s^2), R is the hydraulic radius (m), S is the regional channel slope (m/m), and ρ is the density of water (1000 kg/m^3). Shear velocity is expressed in units of m/s.

Several empirical equations are available to estimate the maximum mobile particle size and each is considered a check on the others (Table A-5) (Pemberton and Lara 1984). The methods described below use channel hydraulic flow parameters, shear velocity, and channel bed shear stress. The maximum mobile particle size in a channel is estimated by taking the average of the different methods.

Table A-5. Methods for estimating bed material mobility.

Method	Reference
Shields' Incipient Motion	Shields (1936)
Lane's Tractive Force Theory	Pemberton and Lara (1984)
Borah Bed Armouring	Borah (1989)
Meyer-Peter Muller	Pemberton and Lara (1984)

The estimated maximum mobile particle size is used to assess the mobility of the bed material in the channel by comparison with an estimate of the median particle size present in the channel. Under conditions where the maximum mobile particle size is greater than the median particle size of the channel bed, the bed material is considered to be frequently mobile. Alternatively, in cases where the maximum mobile particle size is less than the median particle size of the channel bed, bed mobility is considered infrequent.

A.4.4. Wolman Sampling

Various regime and scour equations require an estimation of the median diameter of the bed material (D_{50}). For gravel-bed rivers, the D_{50} of the bed material is assessed using field data collected following the standardized Wolman river bed material sampling method (Wolman 1954). This technique involves randomly picking up and measuring at least 100 pebbles from the river bed at the pipeline crossing or in a representative location in the same reach). The pebbles are measured and classified by size, then counts of pebbles in each size class are compiled to develop a grain size distribution, from which the D_{50} particle size is estimated.

A.4.5. Channels with Cohesive Beds

Conventional approaches to scour prediction were developed from field observations and laboratory experiments in non-cohesive soils, and are generally regarded as overly conservative when applied to cohesive soils. Accurate and accepted methods for predicting scour depths in the more scour-resistant cohesive soils are not yet available to practicing geomorphologists and engineers. The lack of an accurate predictive method often results in an overly conservative design scour depth for cohesive bed channels.

Quantification of channel bed resistance to erosion is site specific and requires laboratory analysis on in-situ samples. Given that the cohesiveness and scour resistance of the substrate is generally not quantified, it is typically assumed by BGC that the bed materials at the pipeline crossings are non-cohesive. In cases where the channel bed material is obviously cohesive, scour depth results may be overestimates.

A.5. BANK EROSION AND ENCROACHMENT ANALYSIS

Much of the methodology presented in the following section has been developed by BGC, and rely significantly on engineering judgement. Bank erosion occurs when bank locations change due to erosion at the channel margins, generally due to channel widening or progressive, gradual erosion from lateral migration of the channel. Channel widening occurs in response to flood events where the channel is forced to convey large flows. Bank erosion may also occur in the absence of large flow events and as a result of gradual erosion along one bank; in this case, the erosion typically occurs along the outer bank of a meander bend and is systematically balanced by the deposition of a point bar on the opposite bank, thus maintaining the channel width (Figure A-6) (Fuller 2007). Encroachment occurs when bank erosion results from migration of the channel bank toward a pipeline that travels parallel and adjacent to the channel flow direction.

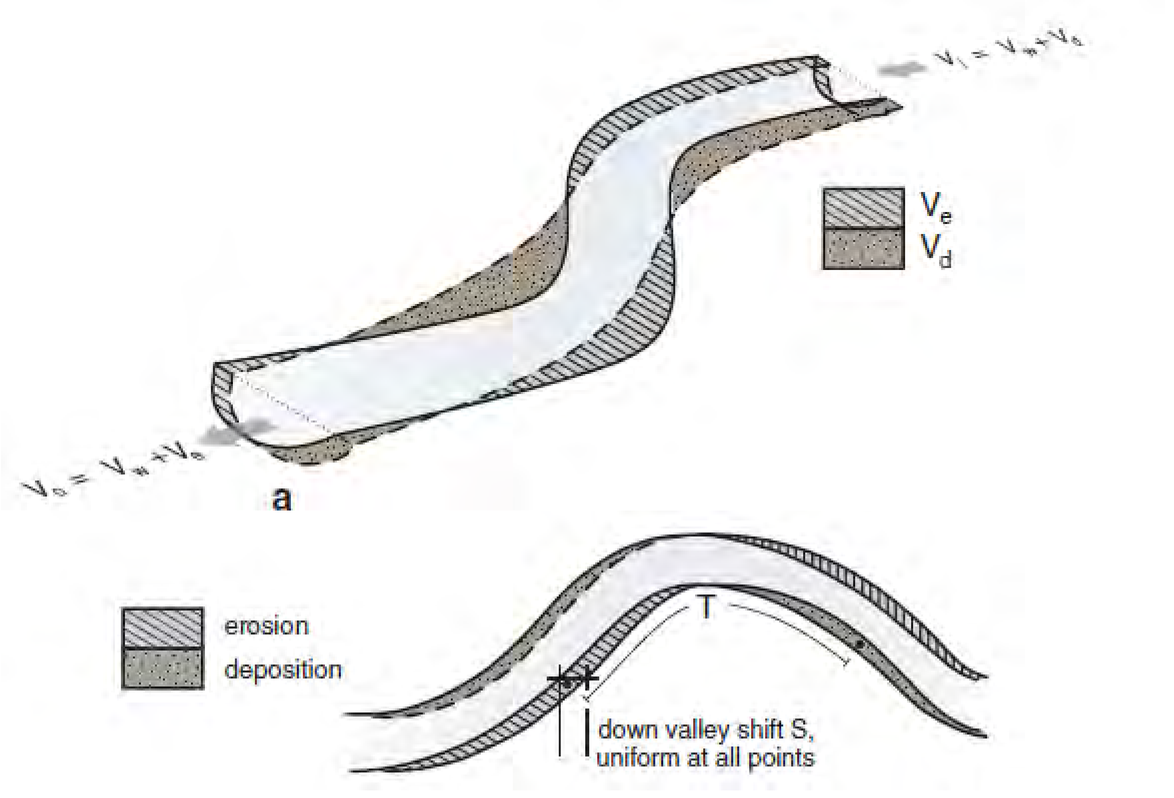


Figure A-5. Illustration of gradual lateral channel migration in meandering rivers (Church 2006).

Figure A-7 illustrates different channel planforms as related to sediment supply and channel stability. These channel types can similarly be related to different forms of bank erosion; erosion due to channel widening is typically associated with inherently unstable channels such as braided or wandering rivers, whereas progressive lateral channel migration is commonly observed in unconfined to semi-confined meandering rivers. The following sections describe the methods used by BGC to assess and quantify bank erosion.

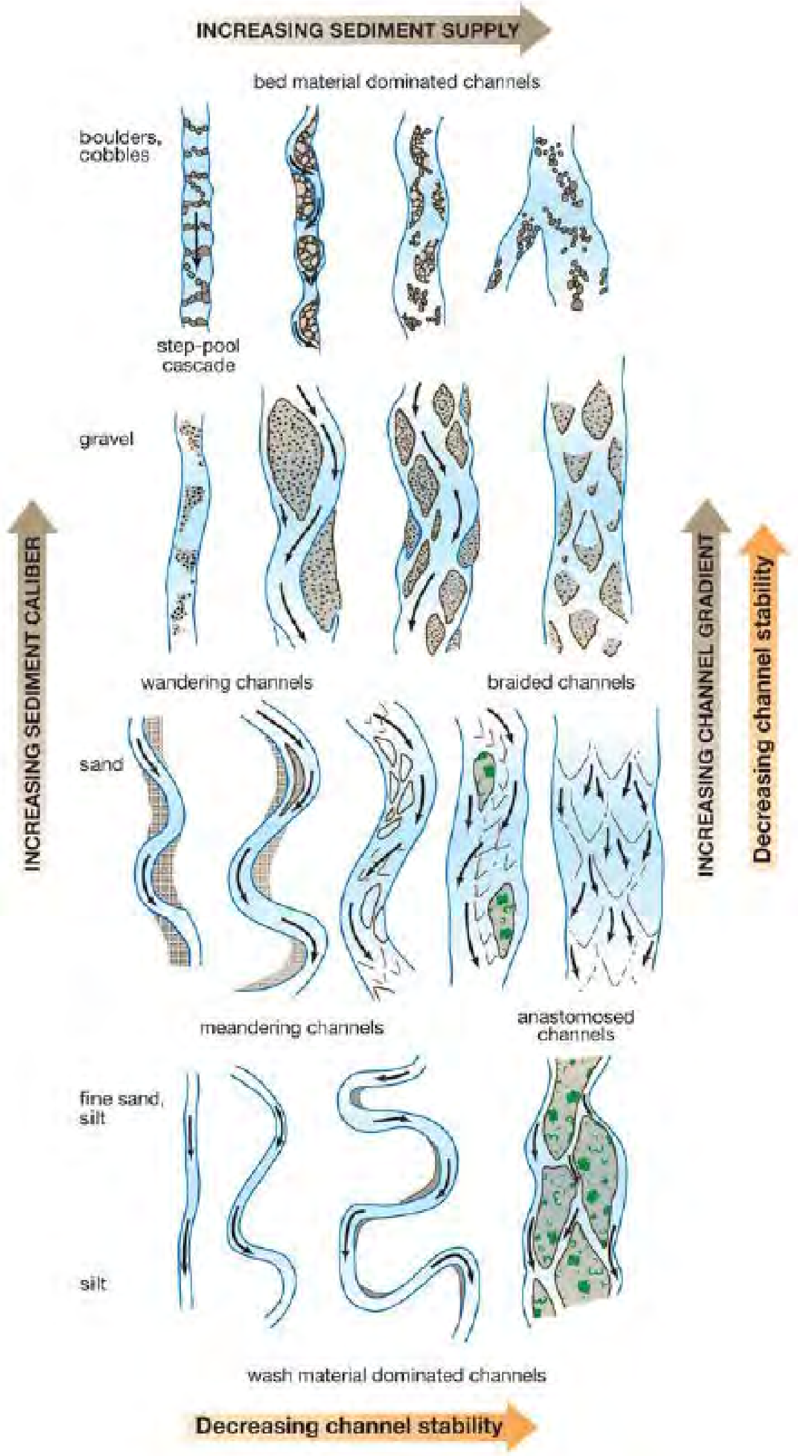


Figure A-6. Illustration of channel planform and related sediment supply and stability (Church 2006).

A.5.1. Historical Assessment of Channel Changes

A channel's susceptibility to lateral migration can be assessed by looking at changes in channel position over time. Historical aerial photographs and satellite imagery can be used to compare and measure changes in the channel position and planform over time. The oldest available aerial photograph is compared to the most recent available imagery (satellite image or orthophoto) to observe noticeable trends in channel stability and lateral movement over a period of decades. This method will generally provide more accurate and reliable results for medium to large rivers (> 15-20 m width) due to limitations in the spatial scale of available imagery and the precision of mapping techniques. Historical aerial photographs at a scale of 1:30,000 or larger are preferred for this assessment.

Aerial photographs are manually georeferenced to enable 2-dimensional (2D) comparison. Georeferencing is done using control points that are constant over time; where possible, a higher density of control points near the watercourse or in the valley is used to minimize distortion near the river banks. For some sites where adequate control data such as LiDAR are available, high-precision orthorectified models are created that are viewable in 3-dimensional (3D) space using the program Summit Evolution^{TM}. In both 2D and 3D cases, banks are delineated from the aerial photographs or models using geographic information system (GIS) software, and the differences in bank locations, which represent erosion or deposition, can be observed and quantified, as relevant. When multiple sets of LiDAR topographic data are available, change analysis techniques can be used to obtain higher precision estimates of recent channel change.

Similar methodologies for historical imagery comparison using both aerial photographs and LiDAR imagery have resulted in spatial error of +/- 2.5 m (Fuller 2007). The spatial accuracy in the BGC method is estimated to be typically about +/-15 m because aerial photographs were not flown specifically for the proposed pipeline crossings and therefore may not be centered, resulting in potential distortion near the crossing location during the georeferencing process.

A.5.2. Encroachment

Progressive lateral movement of the channel toward the pipeline as a result of bank erosion can be evaluated using the same qualitative and quantitative methods as outlined for bank erosion described in the section above. An example of an encroachment hazard is shown in (Figure A-9).

Figure A-7. Example of an encroachment hazard. The blue arrow indicates the channel centerline and flow direction and the red line shows a pipeline centerline location (imagery source: Google Earth, 2004).

A.6. AVULSION ANALYSIS

A.6.1. Background

Avulsion is the creation of a new channel on a floodplain or alluvial fan adjacent to the existing channel location. Scour within an avulsion channel could expose a pipeline, especially where the pipeline rises (and DoC decreases) outside of the boundaries of the main channel or existing channel location. Figure A-9 depicts a typical avulsion hazard in plan view and cross-section.

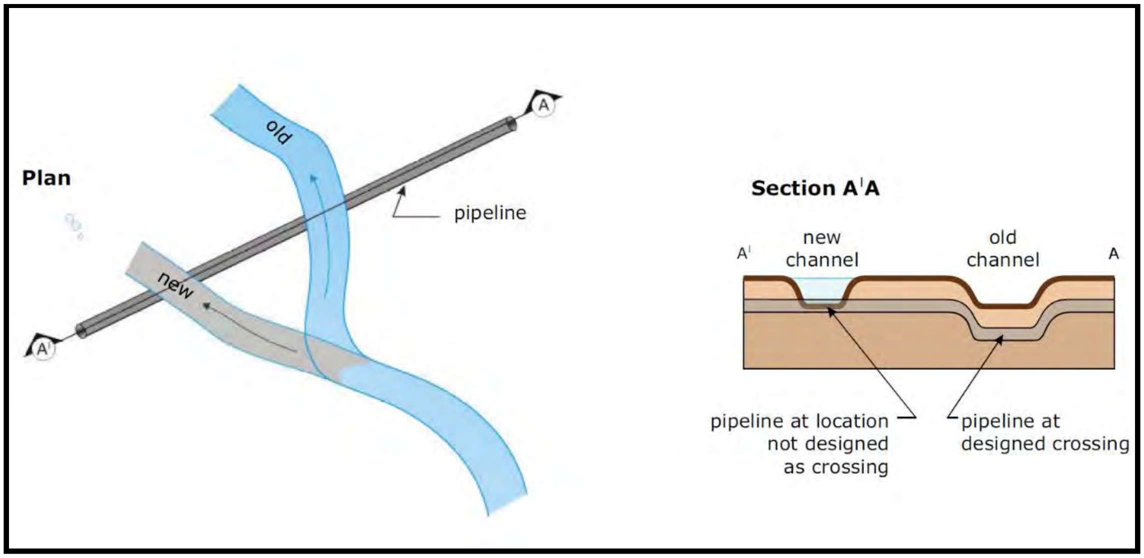


Figure A-8. Example of avulsion in plan view (left) and cross-section (right).

Avulsions in floodplains tend to occur within a limited area known as the channel migration zone (Olson et al. 2014). This zone comprises the modern valley bottom as well as adjacent areas that could be incorporated into the valley bottom through erosion and it can be defined based largely on historical landforms visible in aerial photographs and satellite imagery; however, in streams subject to post-glacial incision, distinguishing between recent and historical landforms that may be abandoned (e.g., oxbow lakes on floodplain surface versus those on elevated terraces) can require considerable judgement.

Within the channel migration zone, the likelihood of island-forming avulsions to occur is highest in previously abandoned secondary channels (Konrad 2012). In meandering streams, avulsion is most likely to occur between meander bends from the formation of neck and chute cutoffs (Slingerland and Smith 2004). Avulsions typically occur in response to a trigger, such as channel blockage (e.g. a log jam) or overland flooding, and the likelihood of avulsion will be greatest when at least one of these triggers is present.

According to Schumm (2005), the underlying causes of avulsions can be organized into four groups as shown in Table A-6. The groupings represent different processes and events that create instability and can lead to avulsion. Generally, increases in the ratio of the potential avulsion path gradient (S_a) to the gradient of existing main channel (S_e) the lead to greater instability and potentially to avulsion. Slingerland and Smith (1998) observed that avulsion tends to occur when the S_a/S_e ratio is greater than 4. Therefore, Groups 1 and 2 include processes or events that affect the S_a/S_e ratio in different ways, while processes and events in Group 3 and 4 are not related to the S_a/S_e ratio.

Table A-6. Causes of avulsions according to Schumm (2005).

Processes and events that create instability and lead to avulsion		Ability of the existing main channel to transport sediment and/or discharge
Group 1		
Avulsion due to increased ratio of S_a/S_e resulting from a decrease in S_e	a) Sinuosity increases	Decrease
	b) Delta growth (lengthening of channel)	Decrease
	c) Base level fall	Decrease
	d) Tectonic uplift	Decrease
Group 2		
Avulsion due to increased ratio of S_a/S_e resulting from an increase in S_a	a) Natural levee/alluvial ridge growth	No change
	b) Alluvial fan and delta growth (convexity)	No change
	c) Tectonism (resulting in lateral tilting)	No change
Group 3		
Avulsion not associated with a change in ratio of S_a/S_e	a) Hydrologic change in flood peak discharge	Decrease
	b) Increased sediment load	Decrease
	c) Vegetative encroachment	Decrease
	d) Log Jams	Decrease
	e) Ice Jams	Decrease
Group 4		
Other avulsions	a) Animal trails	No Change
	b) Capture (diversion into adjacent drainage)	No Change

Note: S_e is the gradient of the existing (main) channel and S_a is the gradient of the potential avulsion course.

Avulsion potential is assessed with qualitative consideration for various factors. Without a floodplain or fan, for example, the potential for avulsion is restricted spatially; channel patterns formed through avulsion (streams with multiple adjacent channels) generally occur in floodplains that are at least four times wider than the bankfull channel width (Beechie and Imaki 2014). Avulsion therefore poses little hazard in entrenched streams as it requires flooding onto elevated terraces, which would only be possible under extreme flows.

In reaches bounded by floodplains, avulsion is most likely to occur within the channel migration zone, typically through the reoccupation of abandoned side channels or as cutoffs between successive meander bends. Avulsion is of greatest concern in aggrading streams, often typified by braided or anabranching channel patterns, where sediment deposition and other triggering factors such as large woody debris may force flows onto the adjacent floodplain (Slingerland and Smith 2004).

Another factor that influences avulsion is the resistance of the valley bottom to vertical erosion. Factors that influence erosion resistance include the nature and abundance of vegetation and the composition and cohesion of floodplain sediments (Constantine et al. 2009; Dunne et al. 2010). Avulsion channels may be more likely to develop in areas with sparse vegetation, such as tilled agricultural fields, than in those with forest cover (Olson et al. 2014).

Olson et al. (2014) recommend that the following factors be considered in an assessment of avulsion potential:

- Cross-valley gradients relative to main channel gradients;
- Areas at lower elevations than the main channel with downstream outlets;
- The presence of abandoned, side or secondary channels that have steeper slopes than the main channel;
- The composition and cohesion of the floodplain and valley bottom sediments;
- Abundance and type of vegetation in potential avulsion pathways;
- Indications of active channel aggradation; and
- Accumulations of large woody debris and channel-spanning log jams.

A.6.2. Assessment

The first step in assessing the potential avulsion hazard for proposed crossings is to delineate the floodplain or fan extents, if relevant, and to identify any contributing factors such as levees, cutoff structures, debris jams, sediment accumulation, beaver dams, debris flow potential, or extreme flooding.

Next, the threshold flow depth for avulsion to occur is quantitatively defined based on the bank elevations at the crossing, which are obtained from survey and LiDAR data. The bank elevation is determined visually as the maximum elevation of the land that separates the stream channel from the floodplain, or the height of the terrace if no floodplain is present. The minimum bank elevation, which is the elevation of the lower of the two banks, defines the threshold flow depth needed to cause overbank flooding and to enable avulsion at the crossing. If this threshold is high, which is typically the case for entrenched reaches, then the design flow does not overtop the banks and avulsion cannot develop in the absence of a blockage. This is common in many Canadian streams, where they flow through valleys carved by larger glacial meltwater channels and are bounded by glaciofluvial terraces. Due to the complex nature of the combination of mechanisms that can initiate avulsion, it is difficult to predict exact avulsion flow paths through a floodplain or fan, even with detailed topographic information for the entire study area.

In addition to establishing an elevation threshold for avulsion at the proposed crossing, avulsion is assessed qualitatively with consideration for additional contributing factors at the reach scale. Avulsion most often initiates at locations with triggering factors (e.g. log jams), or in existing or abandoned side channels that begin in locations where bank elevations are lower than at the crossing; therefore, if active or abandoned side channels are evident in imagery or on the crossing elevation profile, then this may indicate that the elevation threshold for avulsion is lower in a location upstream of the crossing.

REFERENCES

Ashworth, P.J. 1996. Mid-channel bar growth and its relationship to local flow strength and direction. *Earth Surface Processes and Landform* **21** (2): 103‑123.

Barnett, T.P., Adam, J.C., and Lettenmaier, D.P. 2005. Potential impacts of a warming climate on water availability in snow-dominated regions. *Nature* **438:** 303–309.

Beechie, T. and Imaki, H. 2014. Predicting natural patterns based on landscape and geomorphic controls in the Columbia River basin, USA. *Water Resources Research* **50**: 39-57.

Blench, T. 1969. Mobile-bed Fluviology. University of Alberta Press, Edmonton, Alberta.

Borah, D.K. 1989. Scour depth prediction under armouring conditions. *Journal of Hydraulic Division*, ASCE **115** (HY10):1421-1425.

Burn, D. 1994. Hydrologic effects of climatic change in west-central Canada. *Journal of Hydrology* **160:** 53-70.

Burn, D., Fan, L., and Bell, G. 2008. Identification and quantification of streamflow trends on the Canadian Prairies. *Hydrological Sciences* **53**: 538-549.

Church, M. 2006. Bed material transport and the morphology of alluvial river channels. *Annual Review of Earth and Planetary Sciences* **34**: 325-354.

Cohen, S., and Kulkarni, T. (Eds.), 2001. Water management and climate change in the Okanagan Basin. Final Report, Climate Change Action Fund Project A206, 75 pp.

Constantine, J.A., McLean, S.R., and Dunne, T. 2009. A mechanism of chute cutoff along large meandering rivers with uniform floodplain topography. *Geological Society of America Bulletin* **122**: 855–869.

Cooper, R., Peterson A. and Blench T. 1973. Critical review of sediment transport experiments. Proceedings of the American Society of Civil Engineers, Vol. 98, No. HY5. May 1972.

Cubasch, U., Meehl, G.A., Boer, G.J., Stouffer, R.J., Dix, M., Noda, A., Senior, C.A., Raper, S., and Yap, K.S. (eds) 2001. Projections of future climate change. Cambridge University Press, Cambridge, United Kingdom.

Dumanski, S., Pomeroy, J. W., and Westbrook, C. J. 2015. Hydrological regime changes in a Canadian Prairie basin. *Hydrological Processes* **29:** 3893–3904.

Dunne, T., Constantine, J.A., and Singer, M.B. 2010. The role of sediment transport and sediment supply in the evolution of river channel and floodplain complexity. *Transactions, Japanese Geomorphological Union* **31**: 155–170.

Farjan, B., Gupta, A., and Marceau, D.J. 2016. Annual and seasonal variations of hydrological processes under climate change scenarios in two sub-catchments of a complex watershed. Water Resources Management, **30**(8): 2851-2865.

Ferguson, R.I. 2003. The missing dimension: effects of lateral variation on 1-D calculations of fluvial bedload transport. *Geomorphology* **56**: 1-14.

Fleming, S.W. and Barton, M. 2015. Climate trends but little net water supply shift in one of Canada's most water stressed regions over the last century. *Journal of the American Water Resources Association* **51:** 833-841.

Fuller, I.C. 2007. Geomorphic work during a "150-Year" storm: contrasting behaviors of river channels in a New Zealand catchment. *Annals of the Association of American Geographers* **97**(4): 665-676.

Galay, V.J., Yaremko, E.K., and Quazi, M.E. 1987. River bed scour and construction of stone rip rap protection. In: Sediment Transport Gravel Bed Rivers. Edited by: C.R. Thorne, J.C. Bathurst and R.D. Hey. John Wiley and Sons Ltd., p. 353-382.

Gilleland, E. and Katz, R.W. 2006. Analyzing Seasonal to Interannual Extreme Weather and Climate Variability with the Extremes Toolkit. Research Applications Laboratory, National Center for Atmospheric Research.

Gilleland, E. 2016. Package 'extRemes' Extreme Value Analysis [software package]. Version 2.0-8. CRAN. Available from: https://cran.r-project.org/web/packages/extRemes/extRemes.pdf

Gregory, J.M., Mitchell, J.F.B., and Brady, A.J. 1997. Summer drought in northern midlatitudes in a time-dependent CO_2 climate experiment. *Journal of Climate* **10:** 662-686.

Harder, P., Pomeroy, J.W., and Westbrook, C.J. 2015. Hydrological resilience of a Canadian Rockies headwaters basin subject to changing climate, extreme weather, and forest management. *Hydrological Processes* **29:** 3905-3924.

Haschenburger, J.K. and Wilcock, P.R. 2003. Partial transport in a natural gravel bed channel. *Water Resources Research* **39**(1): 1020.

Hatcher, K.L. and Jones, J.A. 2013. Climate and streamflow trends in the Columbia River Basin: evidence for ecological and engineering resilience to climate change. Atmosphere-Ocean, **51**(4): 436-455.

Indian Roads Congress. 1966. Standard Specifications and Code of Practice for Bridges. India.

Ireson, A. M., Barr, A. G., Johnstone, J. F., Mamet, S. D., van der Kamp, G., Whitfield, C. J., Michel, N. L., North, R. L., Westbrook, C. J., DeBeer, C., Chun, K. P., Nazemi, A., and Sagin, J. 2015. The changing water cycle: The Boreal Plains ecozone of Western Canada. *WIRES Water* doi: 10.1002/wat2.1098.

Konrad, C.P. 2012. Reoccupation of floodplains by rivers and its relation to the age structure of floodplain vegetation. *Journal of Geophysical Research* **117:** G00N13.

Lacey, G. 1930. Stable Channels in Alluvium. In Proceedings of the Institution of Civil Engineers. Volume 229.

Leopold, L.B., Wolman, M.G., and Miller, J.P. 1964. Fluvial Processes in Geomorphology. San Francisco: W.H. Freeman.

Li, T., and Hélie, R. 2014. Ecozones of Canada. Update Version – 2014.02. 1:1,000,000. Canadian Council on Ecological Areas (CCEA).

Lindley, E.S. 1919. Regime Channels. Proceedings, Punjab Engineering Congress, 7.

Lindley, E.S. 1919. Regime channels. In *Proceedings of the Punjab Engineering Congress*, Lahore, Pakistan, Vol. 7. pp. 63-74.

Loukas, A., and Quick, M.C. 1999. The effect of climate change on floods in British Columbia. *Nordic Hydrology* **30:** 231-256.

Loukas, A., Vasiliades, L., and Dalezios, N.R. 2002. Potential climate change impacts on flood producing mechanisms in southern British Columbia, Canada using the CGCMA1 simulation results. *Journal of Hydrology* **259:** 163–188.

McParland, D.J., Eaton, B. and Rosenfeld, J. 2014. At-a-station hydraulic geometry simulator. *River Research and Applications*, doi:10.1002/rra.

Mekis, É., and Vincent, L.A. 2011. An overview of the second generation adjusted daily precipitation dataset for trend analysis in Canada. *Atmos Ocean* **49:** 163–177.

Merritt, W.S., Younes, A., Barton, M., Taylor, B., Cohen, S., and Neilsen, D. 2006. Hydrologic response to scenarios of climate change in subwatersheds of the Okanagan basin, British Columbia. *Journal of Hydrology* **326:** 79-108.

Neill, C.R. 1964. River-bed Scour: A Review for Bridge Engineers. Research Council of Alberta. Canadian Good Roads Association. Technical Publication No. 23. pp.47.

Neill, C.R. [Editor]. 1973. Guide to Bridge Hydraulics. University of Toronto Press, Toronto, Canada.

Northwest Hydraulic Consultants Ltd. 1973. Hydraulic model study of scour in gravel-bed rivers. Report prepared for Alyeska Pipeline Service Company. April 1973.

Olson P., Legg, N., Abbe, T., and Reinhardt, M., 2014. A methodology for delineating planning-level channel migration zones. Publication no. 14-06-025, Washington State Department of Ecology, Olympia, Washington.

Pemberton, E.L. and Lara, J.M. 1984. Computing degradation and local scour. Technical Guideline for Bureau of Reclamation, Denver, Colorado, United States.

Pitlick, J. 1994. Relation between peak flows, precipitation, and physiography for five mountainous regions in the western USA. *Journal of Hydrology* **158:** 219-240.

Schindler, D.W., and Donahue, W.F. 2006. An impending water crisis in Canada's western prairie provinces. *Proceedings of the National Academy of Science USA* **103:** 7210-7216.

Schnorbus, M., Werner, A., and Bennett, K. 2014. Impacts of climate change in three hydrologic regimes in British Columbia, Canada. *Hydrological Processes* **28**: 1170-1189.

Schumm, S. A. 2005. River Variability and Complexity. Mussetter Engineering, Inc., USA. Cambridge University Press. Chapter 3, pp 31.

Shields, I.A. 1936. Application of similarity principles and turbulence research to bed-load movement. United States Department of Agriculture Soil Conservation Service, Pasadena, California.

Shook, K. and Pomeroy, J. 2012. Changes in hydrological character of rainfall on the Canadian prairies. *Hydrological Processes* **26:** 1752-1766.

Slingerland, R. and Smith, N.D. 2004. River avulsions and their deposits. *Annual Review of Earth and Planetary Sciences* **32**: 257-285.

Slingerland, R., and Smith, N.D. 1998. Necessary conditions for a meandering-river avulsion: *Geology* **26**, p. 435, doi: 10.1130/0091-7613(1998).

Transportation Association of Canada. 2004. Guide to Bridge Hydraulics, 2nd ed. Thomas Telford Publishing, London, U.K.

Taylor, B., and Barton, M., 2004. Chapter 4. Climate. In Cohen, S., Neilsen, D., and Welbourn, R. (Eds.) Expanding the dialogue on climate change and water management in the Okanagan Basin, British Columbia, Final Report, 24–45.

Veldman, W. 2008. Pipeline Geo-Environmental Design and Geohazard Management. Chapter 3, Open Cut and Elevated River Crossings. Edited by Moness Rizkalla. ASME.

Whitfield, P.H. 2001. Linked hydrologic and climate variations in British Columbia and Yukon. *Environmental Monitoring and Assessment* **67:** 217-238.

Whitfield, P.H., and Pomeroy, J.W. 2016. Changes to flood peaks of a mountain river: implications for analysis of the 2013 flood in the Upper Bow River, Canada. Hydrological Processes, **30**(25): 4657–4673. doi:10.1002/hyp.10957.

Wilcock, P.R. and Crowe, J.C. 2003. Surface-based transport model for mixed-size sediment. *Journal of Hydraulic Engineering* **129**: 120-128.

Wolfe, B.B., Hall, R.I., Last, W.M., Edwards, T.W.D., English, M.C., Karst-Riddoch, T.L., Paterson, A., and Palmini, R. 2006. Reconstruction of multi-century flood histories from oxbow lake sediments, Peace-Athabasca Delta, Canada. *Hydrological Processes* **20:** 4131–4153.

Wolman, M. 1954. A method of sampling coarse river-bed material. *Transactions of the American Geophysical Union* **35**(6): 951-956.

Yaremko, E.K., and Cooper, R.H. 1983. Influence of Northern Pipelines on River Crossing Design. In: Pickell, M.B. (Ed.). Proceedings of the Conference on Pipelines in Adverse Environments II, American Society of Civil Engineers. San Diego, California, November 14-16, 1983. pp. 49-63.

Zwiers, F.W., Schnorbus, M.A., and Maruszeczka, G.D. 2011. Hydrologic impacts of climate change on BC water resources. Summary Report for the Campbell, Columbia and Peace River Watersheds. Pacific Climate Impacts Consortium.

APPENDIX B
BOREHOLE LOGS

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-01

Location: Merritt, BC

Page 1 **of** 6

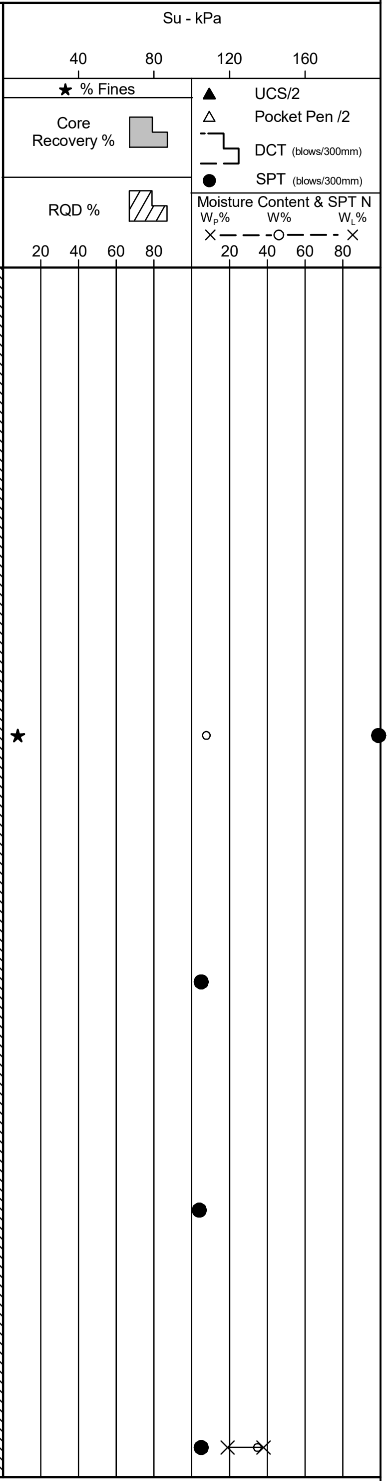
Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,939E, 5,539,288N
Ground Elevation (m): 730.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: PWT **Cased To (m)**: 9.1
Depth To Rock (m):

Start Date: 25 Nov 19
Finish Date: 27 Nov 19
Final Depth of Hole (m): 44.3
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
0					SAND (SW-SM) and gravel fine to coarse, sand fine to medium, trace silt, well graded, very dense, subangular to subrounded, brown, dry, homogeneous, organic odour, maximum observed particle size 30 mm. [FLUVIAL]		
3	⧗	SPT 1			SPT 1: Recovered 0.31 m. Grain size distribution: sand (48.6%), gravel (43.6%), fines (7.8%). Moisture content: 7.7%	29 49 50	
4					CLAY (CL) Silty, low plasticity, soft to firm, greyish brown, wetter than plastic limit (WTPL), homogenous. [FLUVIAL OVERBANK DEPOSITS]		
	⧗	SPT 2			SPT 2: Recovered 0.55 m.	1 2 3	
6	⧗	SPT 3			SPT 3: Recovered 0.56 m.	2 2 2	
					At 6.50 m: 0.5 m of inferred loose granular material due to poor fluid circulation observed by driller		
	⧗	SPT 4			SPT 4: Recovered 0.61 m.	2 1	
8							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-01

Location: Merritt, BC

Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,939E, 5,539,288N
Ground Elevation (m): 730.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: PWT **Cased To (m)**: 9.1
Depth To Rock (m):

Start Date: 25 Nov 19
Finish Date: 27 Nov 19
Final Depth of Hole (m): 44.3
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Su - kPa: 40 80 120 160
★ % Fines | Core Recovery % ▨ | RQD % ▨ | 20 40 60 80
▲ UCS/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N: W_P% W% W_L% ×——○——× 20 40 60 80

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details	Moisture Content & SPT N
8	⧗					4		
9					SAND (SW) Fine to coarse, trace gravel, well graded, very dense, angular to subangular, brownish grey, homogenous. Gravel is subangular to angular and fine to coarse. [FLUVIAL] Between 8.15 m to 9.0 m: Drilling fluid loss (1000 L). Inferred coarse grained material At 9.5 m: Drill bit bouncing on inferred gravel.			
10	⧗	SPT 5			SPT 5: Recovered 0.28 m.	31 40 50		●
11	⧗	SPT 6			SILT (ML) and sand, trace gravel, non-plastic, hard, brownish grey, drier than plastic limit (DTPL), sand is fine to coarse, gravel is fine to coarse, maximum observed particle size 40 mm. [TILL] SPT 6: Recovered 0.12 m.	50 R R		>>●
12	⧗	SPT 7			SPT 7: Recovered 0.26 m.	48 50 R		>>●
13	⧗	SPT 8			SPT 8: Recovered 0.18 m.	43 15 R		>>●
14								
15	⧗	SPT 9			SPT 9: Recovered 0.55 m.	36 41 50		●
16								

(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-01

Location: Merritt, BC

Page 3 **of** 6

Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,939E, 5,539,288N
Ground Elevation (m): 730.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: PWT **Cased To (m)**: 9.1
Depth To Rock (m):

Start Date: 25 Nov 19
Finish Date: 27 Nov 19
Final Depth of Hole (m): 44.3
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Su - kPa: 40 80 120 160
★ % Fines
Core Recovery %
RQD %: 20 40 60 80
▲ UCS/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N: W_P% W% W_L%: 20 40 60 80

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details	Moisture Content & SPT N
16								
	⧗	SPT 10			SPT 10: Recovered 0.28 m. At 16.76 m: Drill bit bouncing on inferred gravel layer beneath SPT 10.	25 50 R		>>●
17								
18					SAND (SM) Silty, trace gravel, fine to medium grained, poorly graded, dense to very dense, subrounded to subangular, brownish grey, inferred wet, homogeneous, maximum observed particle size 50 mm, cobbles inferred from drillers observations. [TILL]			
19								
	⧗	SPT 11			SPT 11: Recovered 0.39 m.	49 44 50		●
20								
21								
22								
	⧗	SPT 12			SPT 12: Recovered 0.1 m.	20 R R		>>●
23								
24								

(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-01

Page 4 **of** 6

Location: Merritt, BC

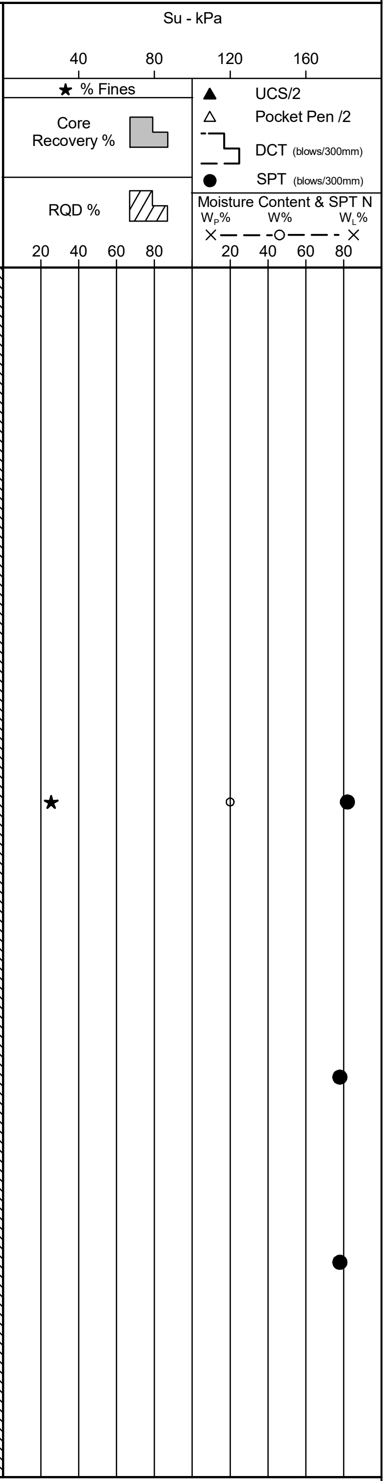
Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,939E, 5,539,288N
Ground Elevation (m): 730.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: PWT **Cased To (m)**: 9.1
Depth To Rock (m):

Start Date: 25 Nov 19
Finish Date: 27 Nov 19
Final Depth of Hole (m): 44.3
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
24 25							
26					At 25.6 m: Drill bit bouncing on inferred gravel and cobble layer for 0.5 m.		
27	⧗	SPT 13			SPT 13: Recovered 0.51 m. Grain size distribution: sand (72.9%), fines (25.4%), gravel (1.7%). Moisture content: 20.0%.	30 38 44	
28 29	⧗	SPT 14			SAND (SM) and silt, trace to some gravel, well-graded, non-plastic, very dense, brownish grey, moist, homogenous, gravel is fine to coarse and subangular. [TILL] SPT 14: Recovered 0.59 m.	14 31 47	
30	⧗	SPT 15			SPT 15: Recovered 0.52 m.	27 29 49	
31 32	⧗						



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-01

Location: Merritt, BC

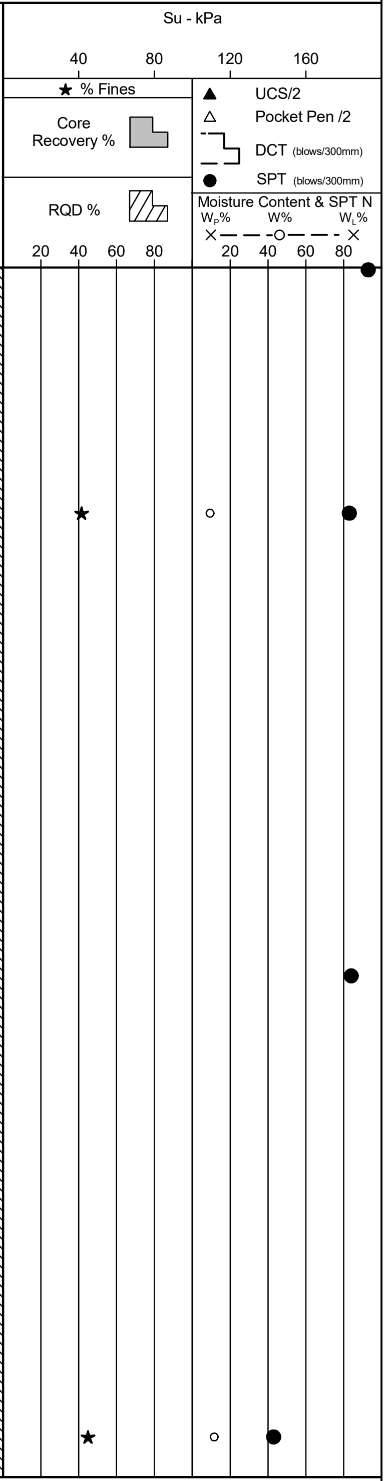
Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,939E, 5,539,288N
Ground Elevation (m): 730.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: PWT **Cased To (m)**: 9.1
Depth To Rock (m):

Start Date: 25 Nov 19
Finish Date: 27 Nov 19
Final Depth of Hole (m): 44.3
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
32		SPT 16			SPT 16: Recovered 0.41 m.	18 43 50	
33		SPT 17			SPT 17: Recovered 0.51 m. Grain size distribution: sand (42.6%), fines (41.5%), gravel (15.9%). Moisture content: 9.4%	22 35 48	
34							
35							
36		SPT 18			SPT 18: Recovered 0.55 m.	18 37 47	
37							
38							
39		SPT 19			SPT 19: Recovered 0.61 m. Grain size distribution: fines (44.9%), sand (38.9%), gravel (16.2%). Moisture content: 11.6%. Low plasticity in silt was observed in SPT 19.	9 19	
40							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-01

Location: Merritt, BC

Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,939E, 5,539,288N
Ground Elevation (m): 730.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: PWT **Cased To (m)**: 9.1
Depth To Rock (m):

Start Date: 25 Nov 19
Finish Date: 27 Nov 19
Final Depth of Hole (m): 44.3
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Su - kPa: 40 80 120 160
★ % Fines
Core Recovery % ▭
RQD % ▨
20 40 60 80
▲ UCS/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N
W_P% W% W_L%
20 40 60 80

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details	Moisture Content & SPT N
40						24		
41	⧗	SPT 20			SPT 20: Recovered 0.14 m.	40 50 R		>>●
42								
					At 42.6 m: Drill bit bouncing on inferred gravel layer for 0.2 m.			
43								
44	⧗	SPT 21			SPT 21: Recovered 0.25 m.	22 50 R		>>●
					END OF BOREHOLE 44.3 m			
45					Borehole completed to target depth of 44.3 m below ground surface. SPT Sampler Details: 609 mm length, 51 mm diameter, driven by automatic trip hammer. All SPT sampling was carried out in accordance with ASTM D1586.			
46					Coordinates provided using Garmin GPSMAP 62s handheld. GPS accuracy +/- 3 m. Elevation provided using LiDAR.			
47					Notes: 1. The borehole was grouted to surface using cement - bentonite grout mix. 2. No instrumentation was installed. 3. Static water level, measured at start of shift in meters below borehole collar, was as follows: November 26: 5.05 m when borehole depth was 10.5 m, casing at 9.1 m depth November 27: 4.45 m when borehole depth was 32.2 m, casing at 9.1 m depth.			
48								

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

TRANSMOUNTAIN

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-02

Location: Merritt, BC

Page 1 **of** 7

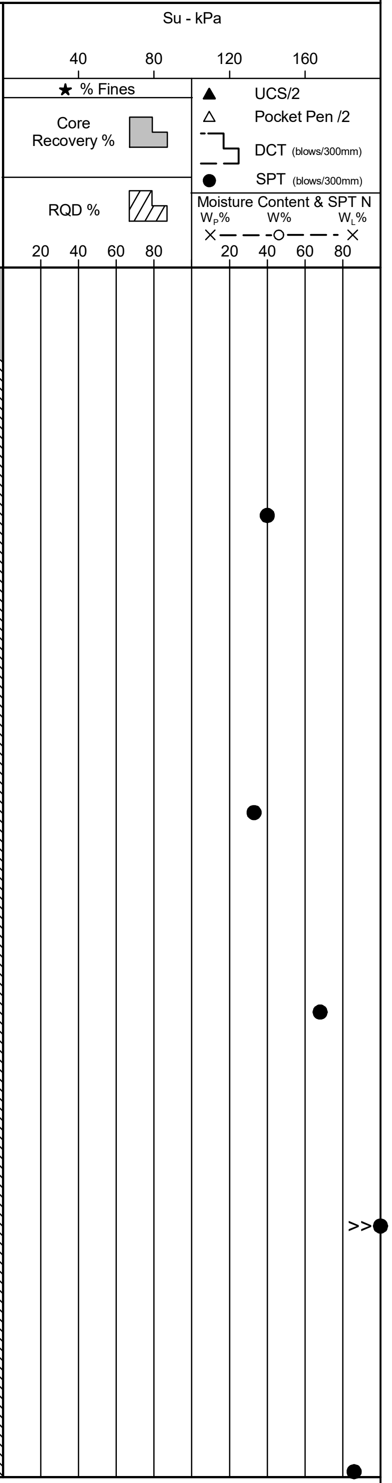
Project No.: 1321150-43

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
0					SAND (SM) gravelly, silty, well graded, dense to very dense, subangular to subrounded, mottled grey, wet, homogeneous. Cobbles inferred from drilling action. [FLUVIAL]		
1							
	⧗	SPT 1			SPT 1: Recovered 0.31 m of 0.46 m (67%)	14 18 22	
2					From 0.00 m to 5.20 m: Drill bouncing on inferred gravel and cobbles.		
3							
	⧗	SPT 2			SPT 2: Recovered 0.28 m of 0.45 m (62%)	2 10 23	
4							
5	⧗	SPT 3			SPT 3: Recovered 0.39 m of 0.45 m (87%). Grain size distribution: sand (51.7%), gravel (28%), fines (20.3%).Moisture content: 17.4	9 19 49	
					SAND (SM) and silt, some gravel, cobbles present, well graded, very dense, brown, wet, homogeneous. Gravel is angular to subangular. 100% fluid circulation. [TILL]		
6	⧗	SPT 4			SPT 4: Recovered 0.29 m of 0.30 m (97%).	19 R	
7							
8	⧗					26	



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-02

Location: Merritt, BC

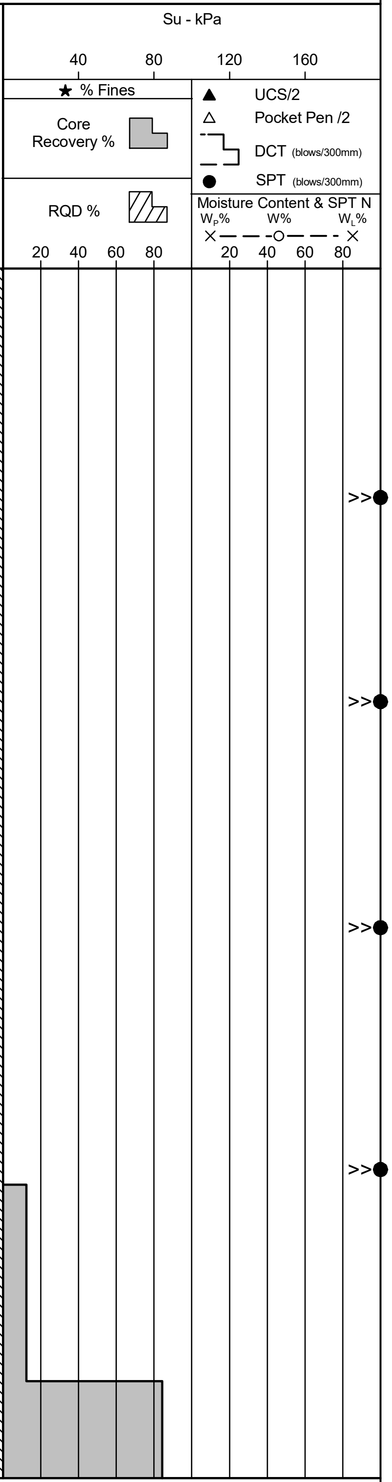
Project No.: 1321150-43

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
8	⧗	SPT 5			SPT 5: Recovered 0.38 m of 0.45 m (84%). Moisture content: 8.9%.	37 49	
9							
	⧗	SPT 6			SPT 6: Recovered 0.45 m of 0.45 m (100%). Grain size distribution: sand (55.3%), fines (21.9%), gravel (19.4%). Moisture content: 13.3%.	25 43 R	
10							
11	⧗	SPT 7			SPT 7: Recovered 0.19 m of 0.46 m (76%).	16 R	
12							
	⧗	SPT 8			SPT 8: Recovered 0.16 of 0.28 m (57%). Moisture content: 9.3%.	14 R	
13							
14	⧗	SPT 9			At 13.86 m: Transition from tricone to HQ coring. SPT 9: Recovered 0.15 m of 0.20 m (75%).	33 R	
15							
16							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-02

Location: Merritt, BC

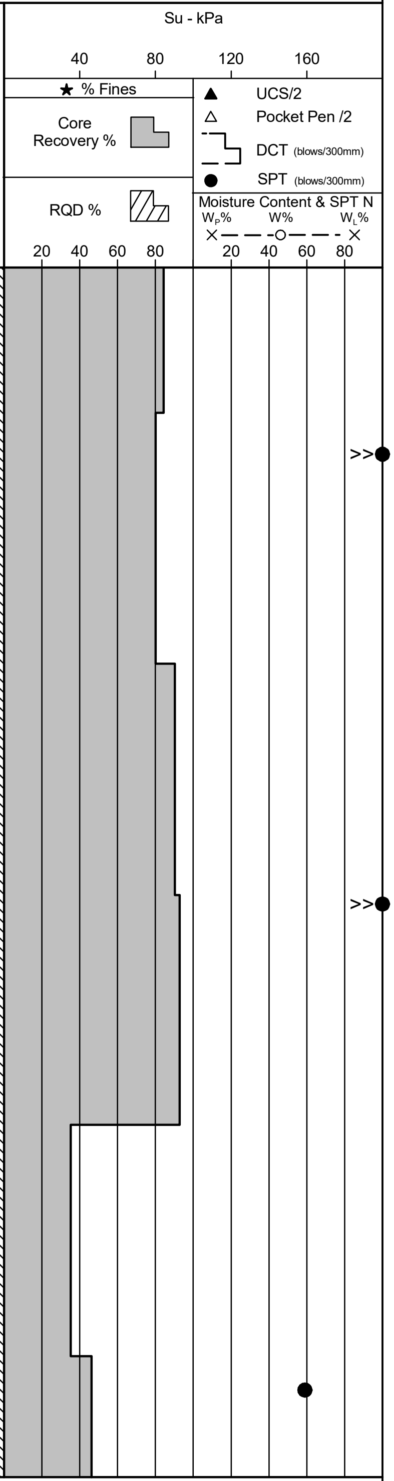
Project No.: 1321150-43

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
16							
17							
		SPT 10			SPT 10: Recovered 0.41 m of 0.41 m (100%). Grain size distribution: sand (44.4%), fines (35.8%), gravel (14.2%). Moisture content: 8.7%.	25 44 R	
18							
19							
20							
		SPT 11			SPT 11: Recovered 0.14 m of 0.14 m (100%).	R	
21							
22							
					At 22.65 m: Cobble washed away core.		
23							
		SPT 12			SPT 12: Recovered 0.54 m of 0.54 m (100%). Moisture content: 11.5%.	15 27 32	
24							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-02

Location: Merritt, BC

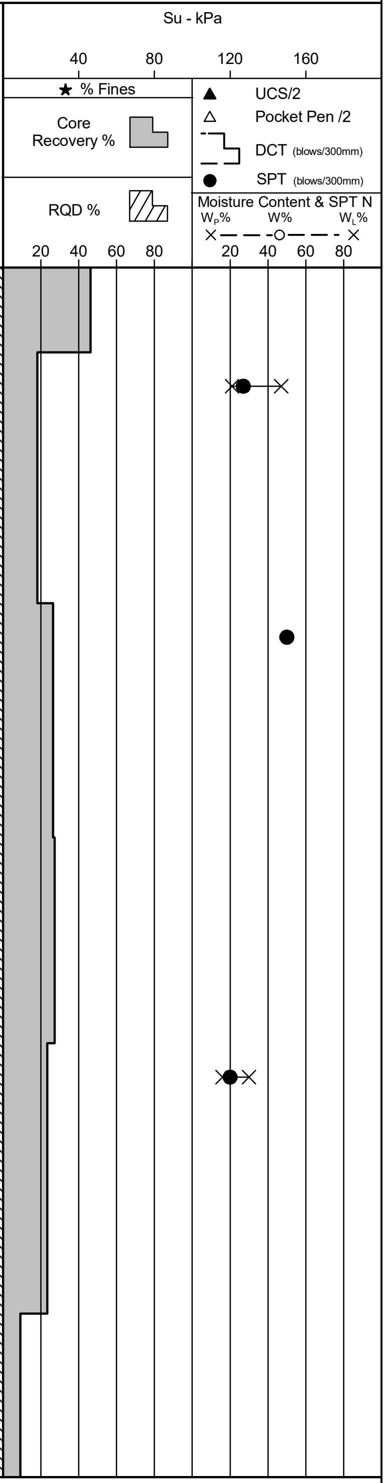
Project No.: 1321150-43

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
24							
	⧗	SPT 13			CLAY (CL) silty, some fine sand, low plasticity, very stiff to hard, NPL, extremely closely spaced fine sand laminations. 100% fluid circulation. [GLACIOLACUSTRINE] SPT 13: Recovered 0.5 m of 0.5 m (100%). Moisture content: 25.2%.	5 9 18	
26	⧗	SPT 14			CLAY (CL) and sand, silty, gravelly, some cobbles, low plasticity, stiff to hard, greyish brown, NPL, widely spaced intervals with no coarse consituents observed 10 - 40 cm in length. 100% fluid circulation. [GLACIOLACUSTRINE] SPT 14: Recovered 0.41 m of 0.46 m (89%).	12 22 28	
	⧗	SPT 15			SPT 15: Recovered 0.37 m of 0.45 m (82%). Grain size distribution: fines (40%), sand (38.7%), gravel (21.3%). Moisture content: 15.2%.	2 8 12	
32							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-02

Location: Merritt, BC

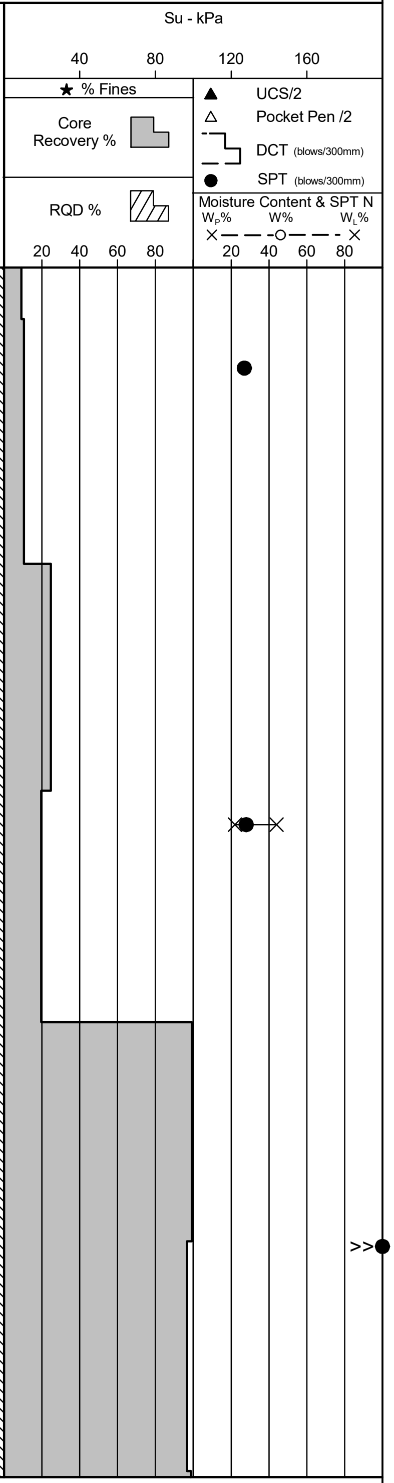
Project No.: 1321150-43

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
32							
	⧗	SPT 16			SPT 16: Recovered 0.40 m of 0.45 m (88%).	11 14 13	
33							
34							
35							
	⧗	SPT 17			SPT 17: Recovered 0.61 m of 0.61 m (100%). Moisture content: 28.5%	4 8 20	
36							
37					SILT (ML) some clay, trace gravel, trace sand, low plasticity, grey, hard, NPL, homogeneous. 100% fluid circulation. [GLACIOLACUSTRINE]		
38							
	⧗	SPT 18			SPT 18: Recovered 0.14 m of 0.14 m (100%). Moisture content: 23.5%.	R	
39							
40							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-02

Location: Merritt, BC

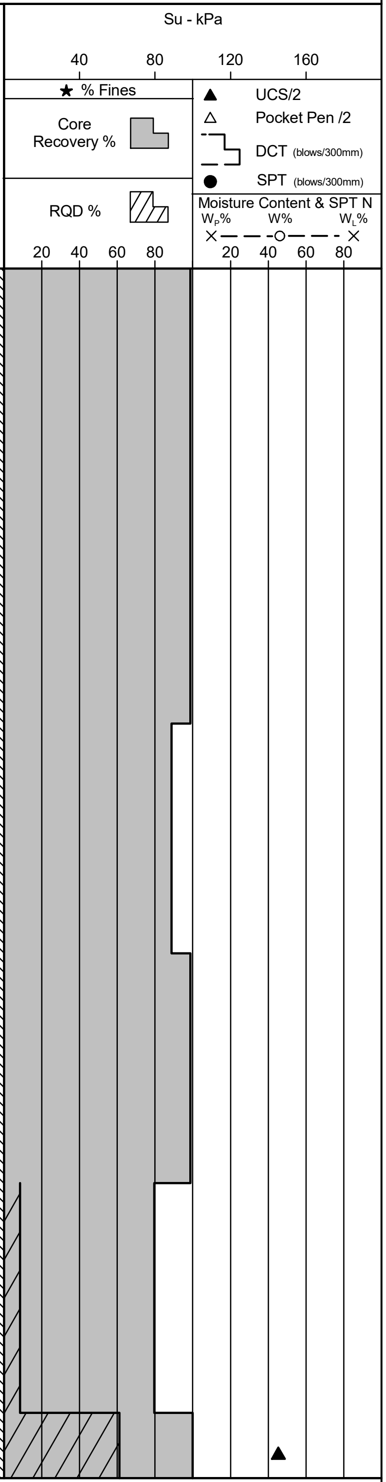
Project No.: 1321150-43

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
40							
43					From 43.25 m to 43.55 m: Zone of soft swelling silty clay.		
46			W 2		RHYOLITIC VOLCANIC ROCK faintly weathered to fresh, medium strong (R3) to strong (R4), light grey, very coarse grained brecciated texture, moderately to widely spaced fractures. 100% fluid circulation. [SPENCES BRIDGE GROUP] From 46.30 m to 47.35 m: Highly fractured bedrock infilled with clay seams.		
47		ARD 2a					
		UCS 1			At 47.71 m: UCS test result of 90.7 MPa.		
48							



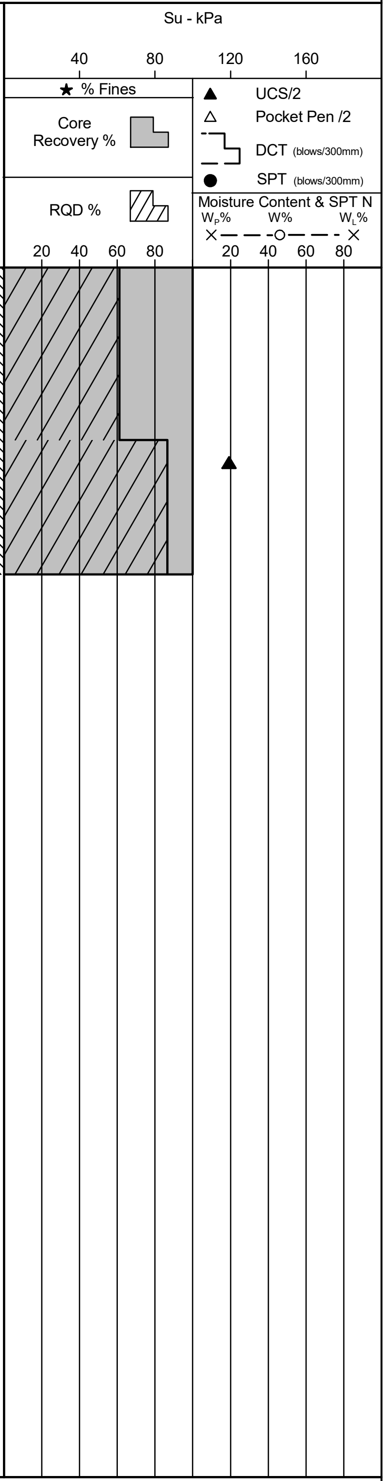
(Continued on next page)

Survey Method: Handheld GPS
Co-ordinates (m): 648,848E, 5,539,625N
Ground Elevation (m): 725.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 46.3

Start Date: 20 Jul 20
Finish Date: 23 Jul 20
Final Depth of Hole (m): 50.0
Logged by: HHA
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
48		ARD 2b ARD 2c					
			W 1.5		At 48.47 m: Clay seam 2 cm thick.		
49		UCS 2 ARD 1a			At 49.18 m: UCS test result of 38.4 MPa.		
		ARD 1b	W 1.5				
50					At 49.96 m: Clay seam 2 cm thick.		



END OF BOREHOLE AT 50.0 m

Borehole completed to depth of 50.0 m below ground surface (mbgs).

101.6 mm inner diameter (I.D.) HW casing installed to 4.36 mbgs.

SPT Sampler Details: 609 mm length, 51 mm diameter, driven by automatic trip hammer. All SPT sampling was carried out in accordance with ASTM D1586.

Coordinates provided using ArcGIS Collector iPad handheld GPS. GPS accuracy +/- 3 m. Elevation provided by LiDAR.

Notes:
1. The borehole was grouted using cement-bentonite grout mix to 0.61 m from surface, then topped to surface with bentonite chips.
2. Static water levels measured at start of shift were as follows:
July 21, 2020: 0.13 mbgs when borehole depth was 2.2 m with no casing.
July 22, 2020: 6.75 mbgs when borehole depth was 20.3 m with casing at 4.4 m depth
July 23, 2020: 2.91 mbgs when borehole depth was 50.0 m with casing at 4.4 m depth.
3. Total water used for drilling (not including grouting): 3000 L.

51
52
53
54
55
56

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-03

Location: Merritt, BC

Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,909E, 5,539,446N
Ground Elevation (m): 724.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: HWT **Cased To (m)**: 12.2
Depth To Rock (m):

Start Date: 28 Nov 19
Finish Date: 29 Nov 19
Final Depth of Hole (m): 42.7
Logged by: ES
Reviewed by: LDM
Approved by: MT

Su - kPa: 40, 80, 120, 160
★ % Fines; Core Recovery %; RQD %: 20, 40, 60, 80
▲ UCS/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N: W_P% W% W_L% (×— —○— —×): 20, 40, 60, 80

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
0					SAND (SW) Medium to coarse, some gravel to gravely, trace cobbles (inferred), trace silt, well graded, loose to compact, subangular to subrounded, brown, moist to wet, heterogeneous. Gravel is polylithic. Maximum observed particle size 150 mm inferred from drilling behaviour. [FLUVIAL]		
3	SPT	SPT 1			At 2.7 m: fluid loss occurs (2000 L). SPT 1: Recovered 0.07 m.	7 5 6	
4.5	SPT	SPT 2			SPT 2: Recovered 0.32 m.	8 7 8	
6	SPT	SPT 3			SPT 3: Recovered 0.37 m. Grain size distribution: sand (75.4%), gravel (15.7%), fines (8.9%). Moisture content: 20.2 %	7 10 12	
7.5	SPT	SPT 4			SPT 4: Recovered 0.27 m.	6 4 5	
8							

(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-03

Location: Merritt, BC

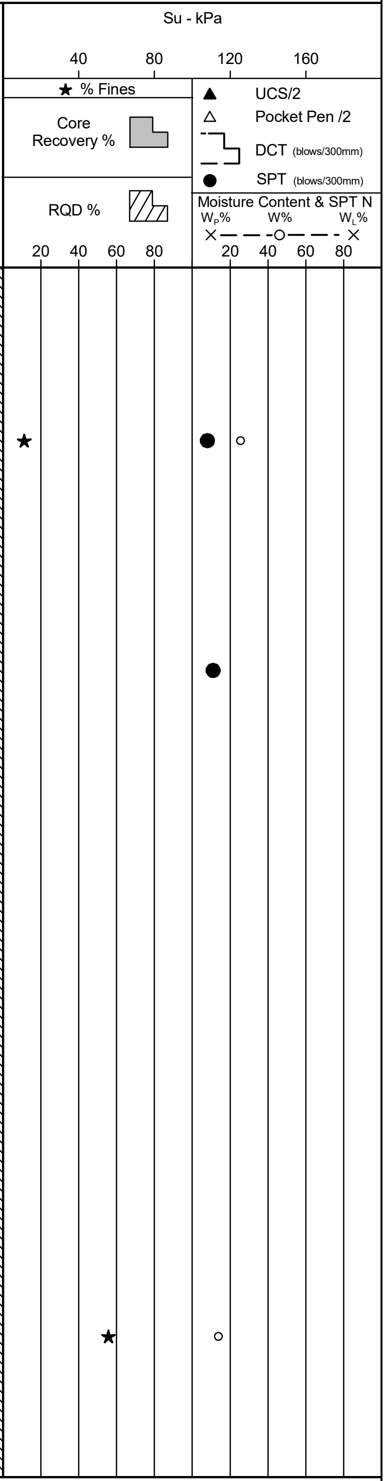
Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,909E, 5,539,446N
Ground Elevation (m): 724.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: HWT **Cased To (m)**: 12.2
Depth To Rock (m):

Start Date: 28 Nov 19
Finish Date: 29 Nov 19
Final Depth of Hole (m): 42.7
Logged by: ES
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
8							
9	⧗	SPT 5			From 8.84 m to 9.45 m (SPT 5): no gravel. SPT 5: Recovered 0.38 m. Grain size distribution: sand (87.9%), fines (11.2%), gravel (0.9%). Moisture content: 25.5%	5 4 4	
10	⧗	SPT 6			SPT 6: Recovered 0.26 m.	6 4 7	
11							
12	⧗	SPT 7			SPT 7: Recovered 0.05 m.	R	
13	⧗	SPT 8			SILT (ML) sandy, trace gravel, trace clay, nonplastic, hard, brown, near plastic limit, heterogeneous, maximum particle size 25 mm. Sand is fine, gravel is angular to subrounded. [TILL] SPT 8: Recovered 0.22 m.	42 R	
14							
15	⧗	SPT 9			SPT 9: Recovered 0.22 m. Grain size distribution: fines (55.7%), sand (34.6%), gravel (9.7%). Moisture content: 13.8%.	33 R	
16							



(Continued on next page)

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

TRANSMOUNTAIN

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-03

Location: Merritt, BC

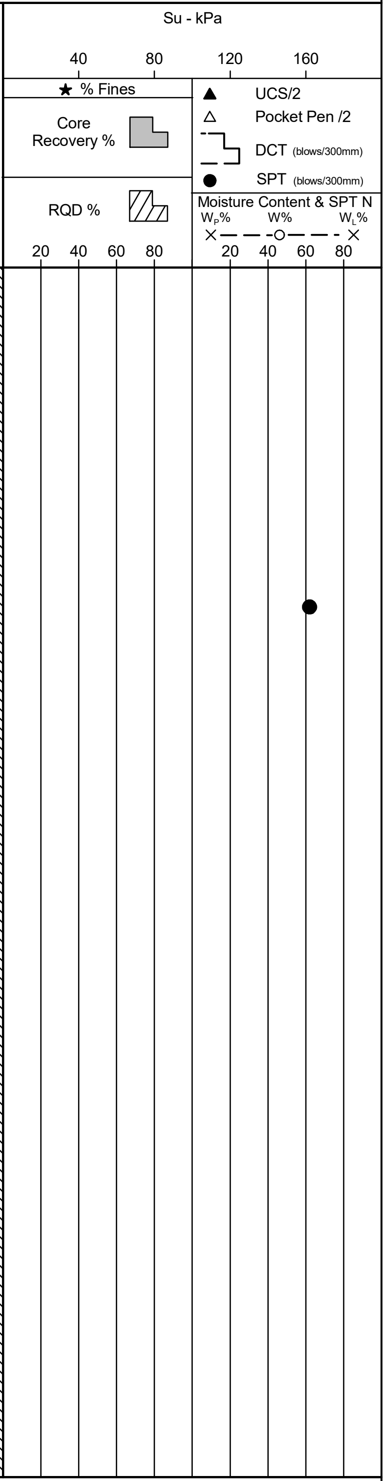
Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,909E, 5,539,446N
Ground Elevation (m): 724.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: HWT **Cased To (m)**: 12.2
Depth To Rock (m):

Start Date: 28 Nov 19
Finish Date: 29 Nov 19
Final Depth of Hole (m): 42.7
Logged by: ES
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
16	⧗	SPT 10			CLAY (CL) Some sand, some gravel (fine to coarse), trace to some silt, low plasticity, hard, brown, near plastic limit, heterogeneous, maximum particle size = 30 mm (gravel). Gravel is subangular to subrounded and polylithic. [TILL] SPT 10: Recovered 0.27 m.	29 R	
17							
18	⧗	SPT 11			SPT 11: Recovered 0.53 m.	14 22 40	
19							
20							
21	⧗	SPT 12			SPT 12: Recovered 0.14 m.	41 R	
22							
23							
24							



(Continued on next page)

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

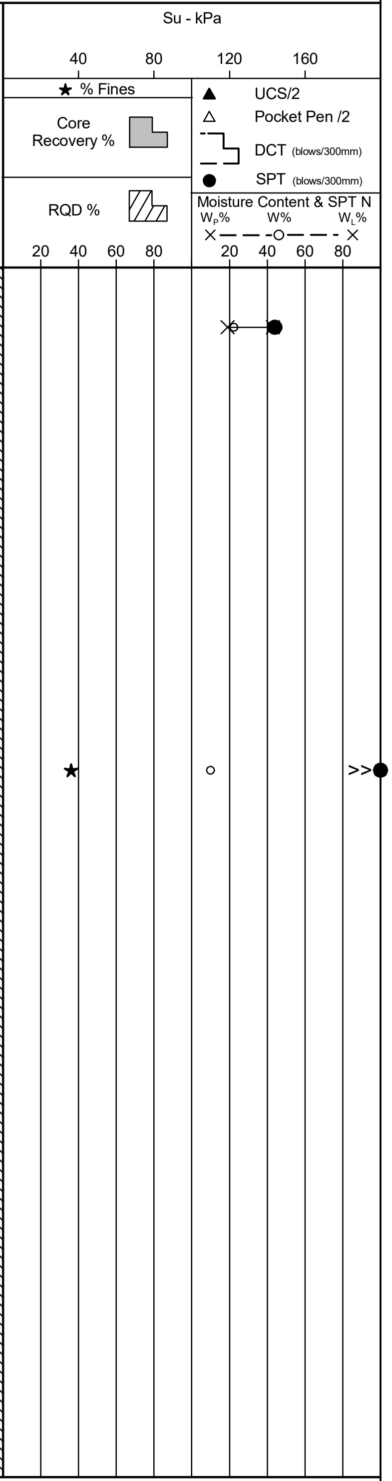
TRANSMOUNTAIN

Survey Method: Handheld
Co-ordinates (m): 648,909E, 5,539,446N
Ground Elevation (m): 724.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: HWT **Cased To (m)**: 12.2
Depth To Rock (m):

Start Date: 28 Nov 19
Finish Date: 29 Nov 19
Final Depth of Hole (m): 42.7
Logged by: ES
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details
24	⧗	SPT 13			CLAY (CL) Silty, trace sand, trace fine gravel, low plasticity, hard, brown, NPL, sand is laminated in 1 mm layers. [GLACIOLACUSTRINE] SPT 13: Recovered 0.61 m.	12 18 26	
26					CLAY (CL) Sandy, gravelly, trace silt, low plasticity, hard, brown, near plastic limit, heterogeneous, maximum observed particle size 30 mm. Gravel is subangular to subrounded and of multiple lithologies. [TILL]		
27	⧗	SPT 14			SPT 14: Recovered 0.57 m. Grain size distribution: sand (37.1%), fines (36.1%), gravel (26.8%). Moisture content: 9.9%	24 33 R	
30	⧗	SPT 15			From 30.18 m to 30.31 m (SPT 15): increased silt content. SPT 15: Recovered 0.16 m.	R	
32							



(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC19-CW5-03

Location: Merritt, BC

Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,909E, 5,539,446N
Ground Elevation (m): 724.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: HWT **Cased To (m)**: 12.2
Depth To Rock (m):

Start Date: 28 Nov 19
Finish Date: 29 Nov 19
Final Depth of Hole (m): 42.7
Logged by: ES
Reviewed by: LDM
Approved by: MT

Su - kPa: 40, 80, 120, 160
★ % Fines
Core Recovery % ▨
RQD % ▨
▲ UCS/2
△ Pocket Pen /2
DCT (blows/300mm)
● SPT (blows/300mm)
Moisture Content & SPT N: W_P% W% W_L% (×— —○— —×)
20 40 60 80

Depth (m)	Sample Type	Sample No.	Weathering Grade	Symbol	Lithologic Description	SPT Blows per 150mm	Install Details	Plots
32								
33.3	⧗	SPT 16			SPT 16: Recovered 0.29 m.	26 R		
35					GRAVEL (GW) Fine to coarse, sandy, trace clay, well graded, very dense, angular to rounded, brown to black, wet, maximum observed particle size 30 mm. [GLACIOFLUVIAL]			
36.3	⧗	SPT 17			SPT 17: Recovered 0.06 m.	R		
37					At approximately 37 m: artesian conditions encountered (while pulling rods prior to SPT 18).			
39.5	⧗	SPT 18			SPT 18: Recovered 0.3 m. Grain size distribution: gravel (47.1%), sand (45.9%), fines (7%). Moisture content: 14.0%	48 50 R		★ ○ >>●
40								

(Continued on next page)

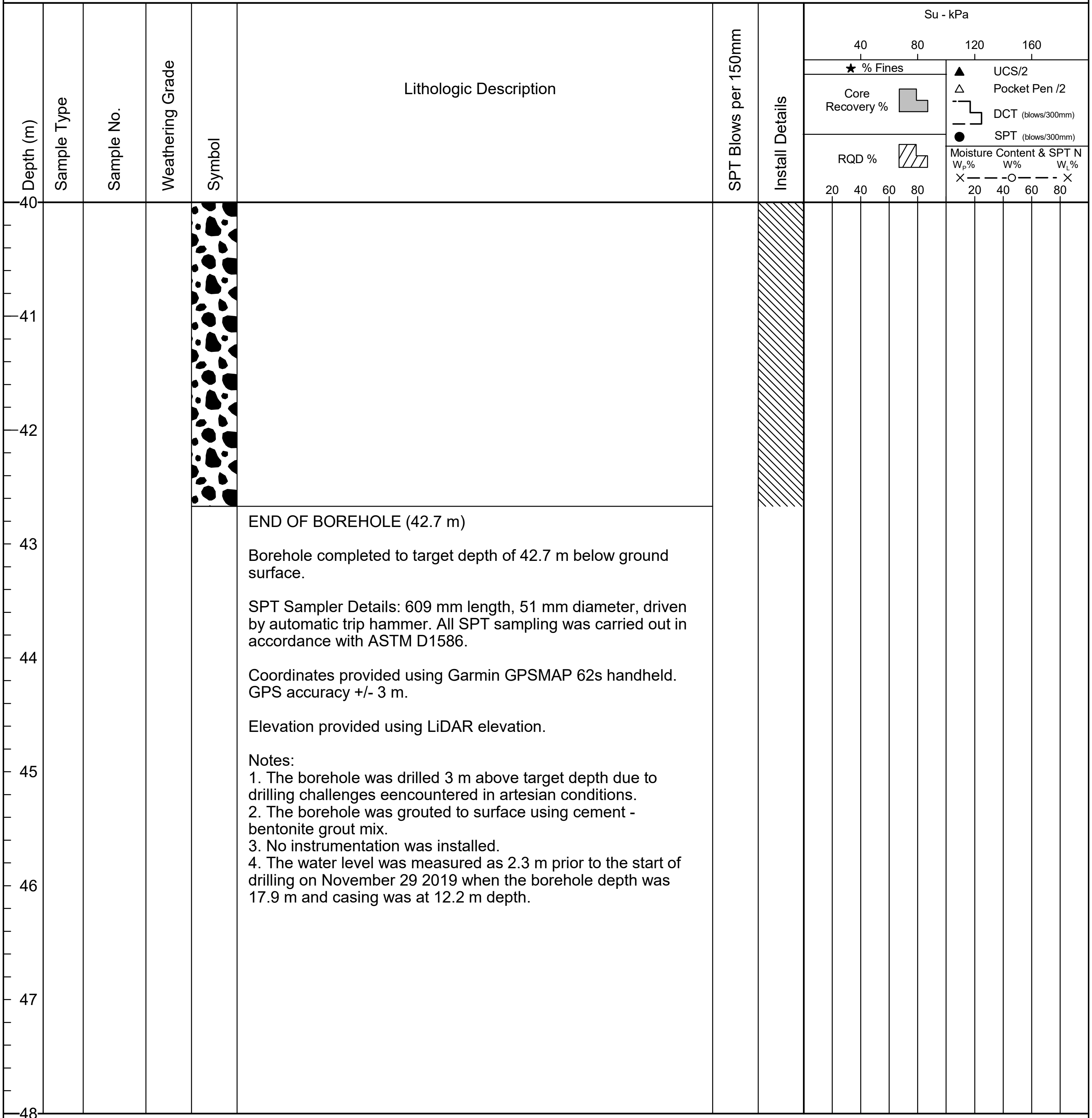
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

TRANSMOUNTAIN

Survey Method: Handheld
Co-ordinates (m): 648,909E, 5,539,446N
Ground Elevation (m): 724.0
Datum: UTM Zone 10U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/Polymer
Casing: HWT **Cased To (m)**: 12.2
Depth To Rock (m):

Start Date: 28 Nov 19
Finish Date: 29 Nov 19
Final Depth of Hole (m): 42.7
Logged by: ES
Reviewed by: LDM
Approved by: MT



END OF BOREHOLE (42.7 m)

Borehole completed to target depth of 42.7 m below ground surface.

SPT Sampler Details: 609 mm length, 51 mm diameter, driven by automatic trip hammer. All SPT sampling was carried out in accordance with ASTM D1586.

Coordinates provided using Garmin GPSMAP 62s handheld. GPS accuracy +/- 3 m.

Elevation provided using LiDAR elevation.

Notes:
1. The borehole was drilled 3 m above target depth due to drilling challenges eencountered in artesian conditions.
2. The borehole was grouted to surface using cement - bentonite grout mix.
3. No instrumentation was installed.
4. The water level was measured as 2.3 m prior to the start of drilling on November 29 2019 when the borehole depth was 17.9 m and casing was at 12.2 m depth.

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-04

Location: Merritt, BC

Page 1 **of** 3

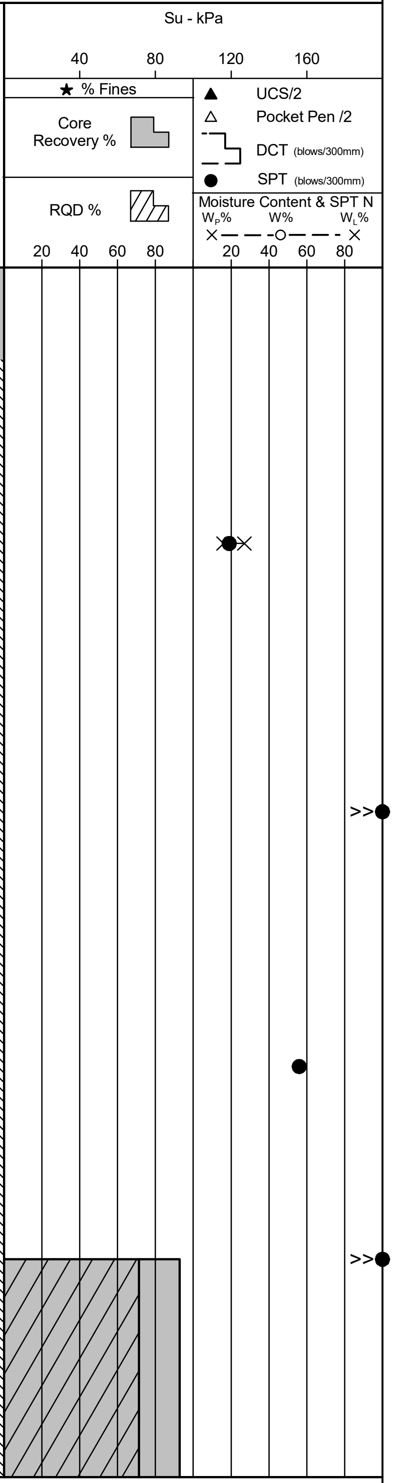
Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,797E, 5,539,886N
Ground Elevation (m): 748.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/ Water
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 6.6

Start Date: 23 Jul 20
Finish Date: 24 Jul 20
Final Depth of Hole (m): 20.3
Logged by: JPN
Reviewed by: LDM
Approved by: MT

Depth (m)	Sample Type	Sample No.	Weathering Grade	Lithologic Description	SPT Blows per 150mm
0				GRAVEL (GW-GM) Fine to coarse, cobbles, sandy, silty, gap graded to well graded, inferred compact to dense, angular to subangular, mottled grey, wet, homogenous. [COLLUVIUM] At 0.30 m: Boulder 0.33 m in length. Driller noted cobbles and boulders due to drilling action. At 0.30 m: Driller consequently switched from tricone drilling to diamond coring.	
2	⧗	SPT 1		SPT 1: Recovered 0.35 m of 0.45 m (78%). Grain size distribution: gravel (34.8%), sand (31.5%), fines (28.9%). Moisture content: 16.2%.	15 10 9
3		SPT 2		At 3.40 m: Increased presence of cobbles SPT 2: No recovery. Hammer bouncing upon refusal.	R
4				Casing advanced to 4.42 m.	
5				At 4.93 m: cobble 0.12 m in length.	
5	⧗	SPT 3		SAND (SM) Fine to coarse, silty, gravelly, trace cobbles, well graded, very dense, sub-angular, red to brown, moist, homogenous. [TILL] SPT 3: Recovered 0.32 m of 0.45 m (71%). Grain size distribution: sand (50.1%), fines (27%), gravel (22.9%). Moisture content: 9.2%.	17 27 29
6		SPT 4		SPT 4: No recovery. Hammer bouncing upon refusal.	R
7		ARD 1a ARD 1b	3	ANDESITIC VOLCANIC ROCK Slightly weathered, medium strong (R3) to very strong (R5), medium grained, light red to grey, porphyritic, some medium grained plagioclase and k-feldspar with trace quartz, uniform, closely spaced fractures with orange to yellow alteration and iron straining. [SPENCES BRIDGE GROUP]	
8					



(Continued on next page)

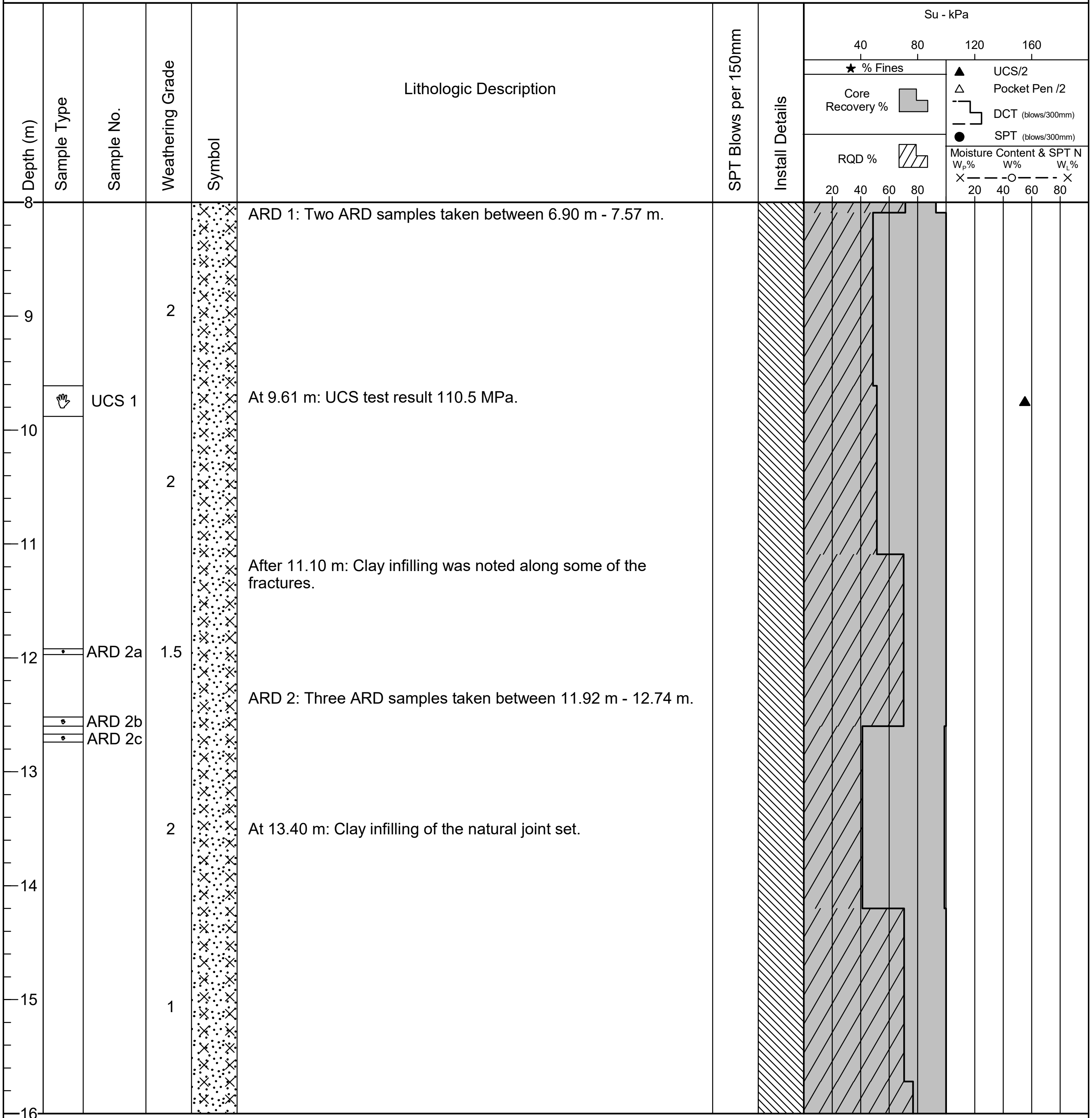
BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

TRANSMOUNTAIN

Survey Method: Handheld
Co-ordinates (m): 648,797E, 5,539,886N
Ground Elevation (m): 748.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/ Water
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 6.6

Start Date: 23 Jul 20
Finish Date: 24 Jul 20
Final Depth of Hole (m): 20.3
Logged by: JPN
Reviewed by: LDM
Approved by: MT



ARD 1: Two ARD samples taken between 6.90 m - 7.57 m.

At 9.61 m: UCS test result 110.5 MPa.

After 11.10 m: Clay infilling was noted along some of the fractures.

ARD 2: Three ARD samples taken between 11.92 m - 12.74 m.

At 13.40 m: Clay infilling of the natural joint set.

(Continued on next page)

Project: Coldwater IR HDD

DRILL HOLE # BH-BGC20-CW5-04

Page 3 **of** 3

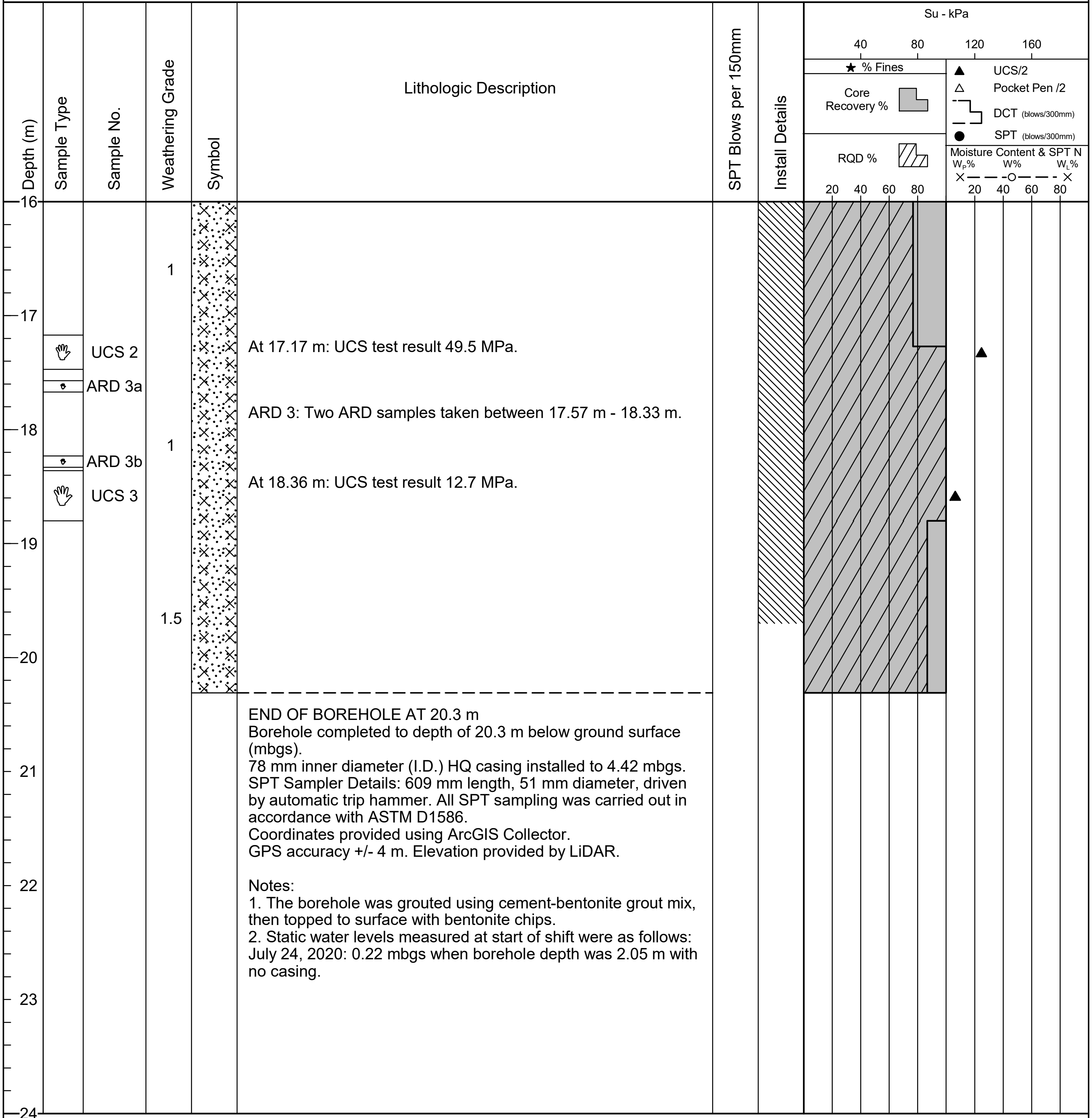
Location: Merritt, BC

Project No.: 1321150-43

Survey Method: Handheld
Co-ordinates (m): 648,797E, 5,539,886N
Ground Elevation (m): 748.0
Datum: UTM 10 U
Dip (degrees from horizontal): 90
Direction: N/A

Drill Designation: Fraste MDXL
Drilling Contractor: Geotech Drilling
Drill Method: Mud Rotary
Fluid: Bentonite/ Water
Casing: HWT **Cased To (m)**: 4.4
Depth To Rock (m): 6.6

Start Date: 23 Jul 20
Finish Date: 24 Jul 20
Final Depth of Hole (m): 20.3
Logged by: JPN
Reviewed by: LDM
Approved by: MT



At 17.17 m: UCS test result 49.5 MPa.

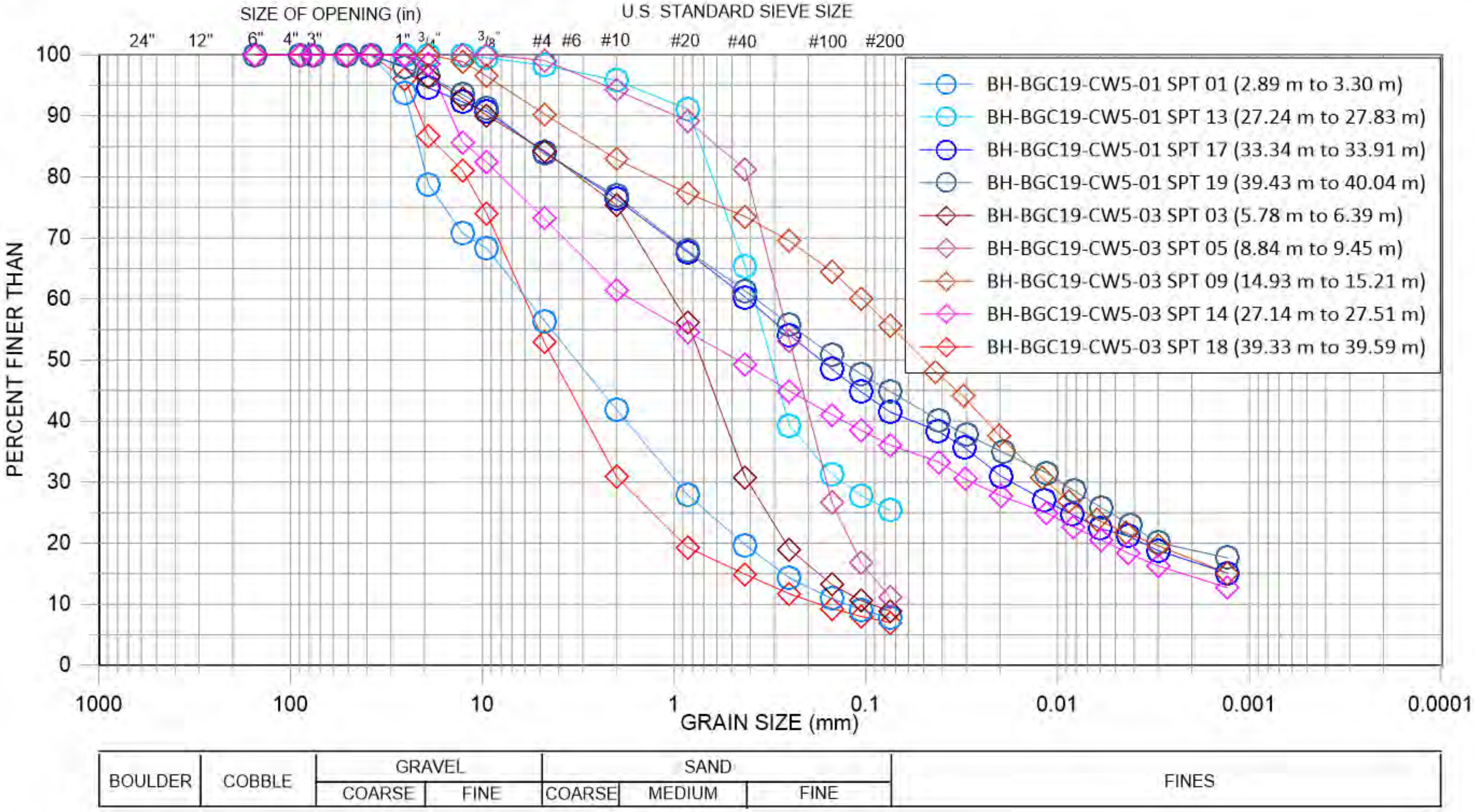
ARD 3: Two ARD samples taken between 17.57 m - 18.33 m.

At 18.36 m: UCS test result 12.7 MPa.

END OF BOREHOLE AT 20.3 m
Borehole completed to depth of 20.3 m below ground surface (mbgs).
78 mm inner diameter (I.D.) HQ casing installed to 4.42 mbgs.
SPT Sampler Details: 609 mm length, 51 mm diameter, driven by automatic trip hammer. All SPT sampling was carried out in accordance with ASTM D1586.
Coordinates provided using ArcGIS Collector.
GPS accuracy +/- 4 m. Elevation provided by LiDAR.

Notes:
1. The borehole was grouted using cement-bentonite grout mix, then topped to surface with bentonite chips.
2. Static water levels measured at start of shift were as follows:
July 24, 2020: 0.22 mbgs when borehole depth was 2.05 m with no casing.

APPENDIX C
LABORATORY TEST RESULTS



NOTE:
1. Material classification plotted according to the Unified Soil Classification System (USCS).
2. Laboratory analysis completed by Golder Associates Ltd.

SCALE:	N.T.S.	DESIGNED:	HHA
DATE:	SEP 2020	CHECKED:	PQ
DRAWN:	HHA	APPROVED:	MT

DWG TO BE READ WITH BGC REPORT TITLED
'GEOTECHNICAL HDD FEASIBILTY ASSESSMENT
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5'
DATED SEPTEMBER 2020.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

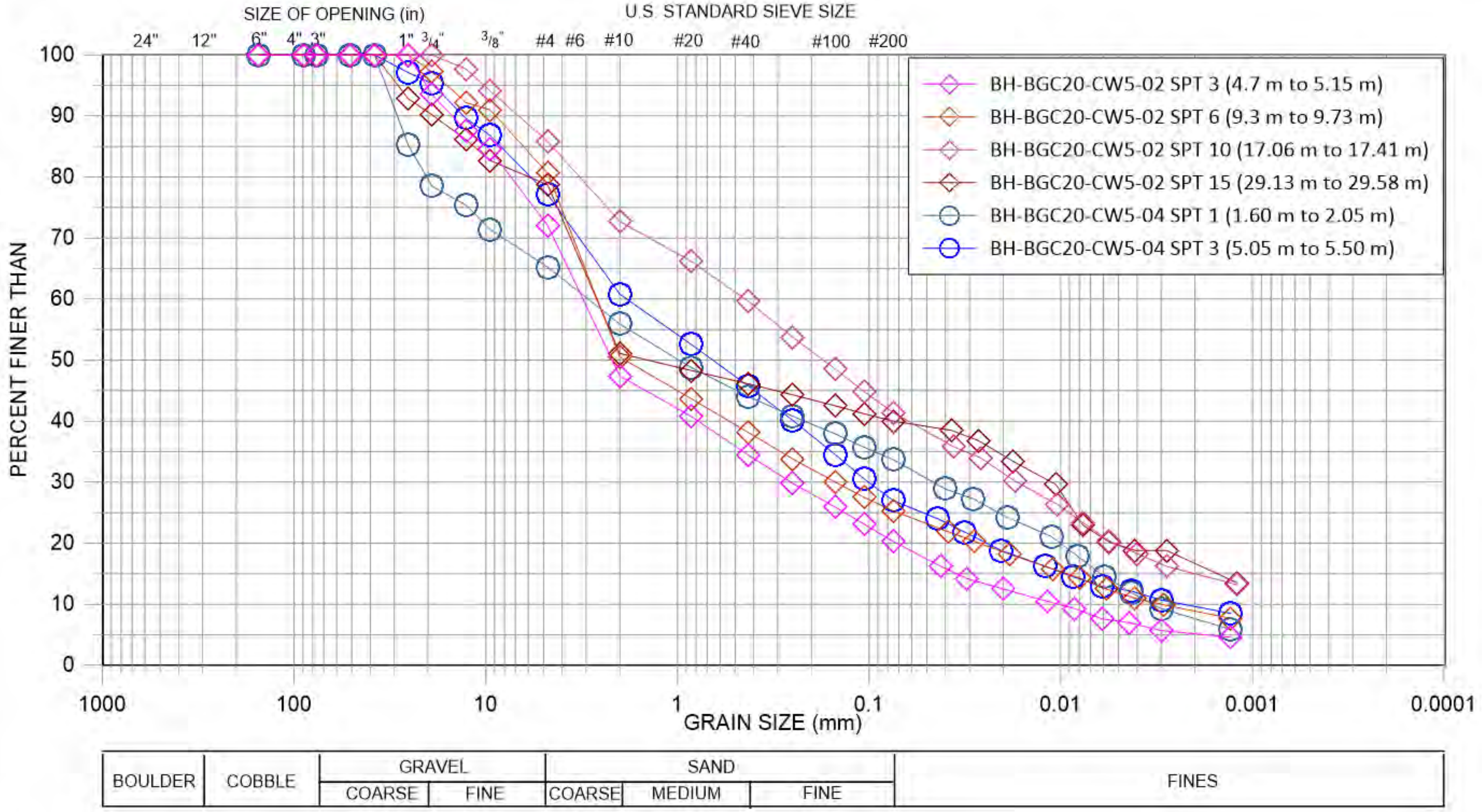
CLIENT:
TRANSMOUNTAIN

PROJECT:
GEOTECHNICAL HDD FEASIBILTY ASSESSMENT
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
GRAIN SIZE ANALYSIS RESULTS
BH-BGC19-CW5 -01 & -03

PROJECT No.	DWG No.	REV.
1321-150-43	C-01	A

\\bgcengineering.ca\Shares\N\BGC\Projects\1321 Trans Mountain\150 - TMEP Pipeline Project\14 HDD Investigation\06 (2019 Investigations)\Coldwater IR\Crossing 1 (South)\Lab Results



NOTE:
1. Material classification plotted according to the Unified Soil Classification System (USCS).
2. Laboratory analysis completed by Golder Associates Ltd.

SCALE: N.T.S.	DESIGNED: HHA		
DATE: SEP 2020	CHECKED: PQ		
DRAWN: HHA	APPROVED: MT		

DWG TO BE READ WITH BGC REPORT TITLED 'GEOTECHNICAL HDD FEASIBILTY ASSESSMENT COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5' DATED SEPTEMBER 2020.

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

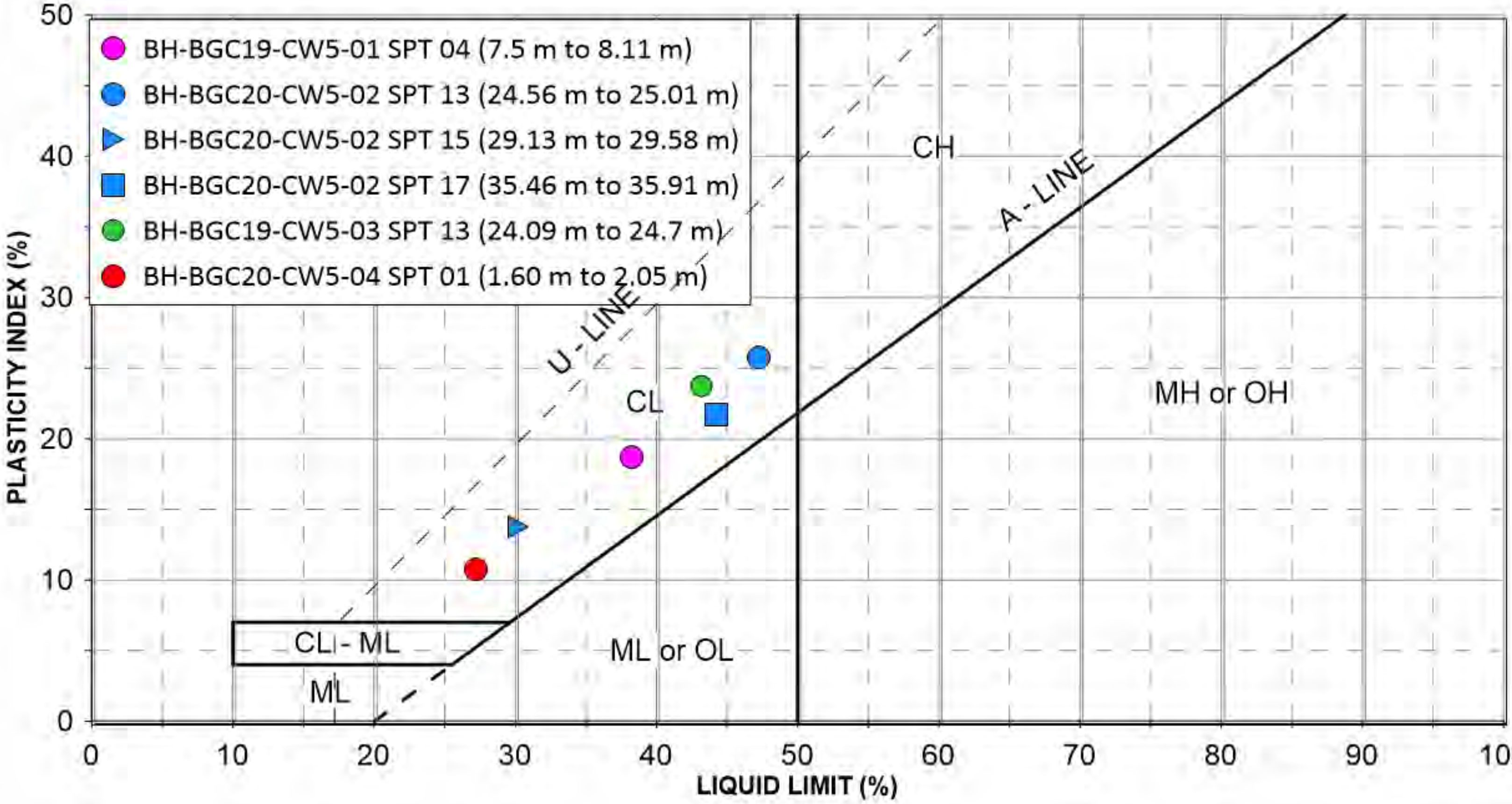
CLIENT:
TRANSMOUNTAIN

PROJECT:
GEOTECHNICAL HDD FEASIBILTY ASSESSMENT
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
GRAIN SIZE ANALYSIS RESULTS
BH-BGC20-CW5 -02 & -04

PROJECT No.	DWG No.	REV.
1321-150-43	C-02	A

\\bgcengineering.ca\Shares\N\BGC\Projects\1321 Trans Mountain\150 - TMEP Pipeline Project\14 HDD Investigation\06 (2019 Investigations)\Coldwater IR\Crossing 1 (South)\Lab Results



NOTES:
1. Material classification plotted according to the Unified Soil Classification System (USCS).
2. Laboratory analysis completed by Golder Associates Ltd.

SCALE:	N.T.S.	DESIGNED:	HHA
DATE:	SEP 2020	CHECKED:	PQ
DRAWN:	HHA	APPROVED:	MT

DWG TO BE READ WITH BGC REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY ASSESSMENT COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5" DATED SEPTEMBER 2020

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT:
TRANSMOUNTAIN

PROJECT:
GEOTECHNICAL HDD FEASIBILTY ASSESSMENT
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
ATTERBERG LIMIT ANALYSIS RESULTS
COLDWATER SOUTH

PROJECT No.:	DWG No.:	REV.:
1321-150-43	C-03	A

\\bgcengineering.ca\Shares\NBGC\Projects\1321 Trans Mountain\150 - TMEP Pipeline Project\14 HDD Investigation\06 (2019 Investigations)\Coldwater IR\Crossing 1 (South)\Lab Results

WATER CONTENT DETERMINATION

ASTM D 2216

Client: BGC Engineering Inc. **Lab Schedule No.: B19-417**

Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13

Location: Not Given

Project No.: 19131807 **Phase:** 6000

Sample Location	Sample No.	Specimen No.	Depth Interval		Water Content (%)
			Depth (m)	Bottom (m)	
BH-BGC19-CW5-01	**1**		2.89	3.30	**7.7**
BH-BGC19-CW5-01	**4**		7.50	8.11	**34.8**
BH-BGC19-CW5-01	**13**		27.24	27.83	**20.0**
BH-BGC19-CW5-01	**17**		33.34	33.91	**9.4**
BH-BGC19-CW5-01	**19**		39.43	40.04	**11.6**
BH-BGC19-CW5-03	**3**		5.78	6.39	**20.2**
BH-BGC19-CW5-03	**5**		8.84	9.45	**25.5**
BH-BGC19-CW5-03	**9**		14.93	15.21	**13.8**
BH-BGC19-CW5-03	**13**		24.09	24.70	**22.3**
BH-BGC19-CW5-03	**14**		27.14	27.51	**9.9**
BH-BGC19-CW5-03	**18**		39.33	39.59	**14.0**

Checked	Date
SJ	1/13/2020

GOLDER

WATER CONTENT DETERMINATION

ASTM D 2216

Client: BGC Engineering Inc. **Lab Schedule No.: B20-264**

Project: TMEP CWIR South; BGC Project No.: 1321150-43.04

Location: Not Given

Project No.: 19131807 **Phase:** 18000

Sample Location	Sample No.	Specimen No.	Depth Interval		Water Content (%)
			Depth (m)	Bottom (m)	
BH-BGC20-CW5-02	**SPT-03**		4.70	5.15	**17.4**
BH-BGC20-CW5-02	**SPT-05**		7.74	8.19	**8.9**
BH-BGC20-CW5-02	**SPT-06**		9.30	9.73	**13.3**
BH-BGC20-CW5-02	**SPT-08**		12.22	12.50	**9.3**
BH-BGC20-CW5-02	**SPT-10**		17.06	17.41	**8.7**
BH-BGC20-CW5-02	**SPT-12**		23.20	23.65	**11.5**
BH-BGC20-CW5-02	**SPT-13**		24.56	25.01	**25.2**
BH-BGC20-CW5-02	**SPT-15**		29.13	29.58	**15.2**
BH-BGC20-CW5-02	**SPT-17**		35.46	35.91	**28.5**
BH-BGC20-CW5-02	**SPT-18**		38.45	38.50	**23.5**
BH-BGC20-CW5-04	**SPT-01**		1.60	2.05	**16.2**
BH-BGC20-CW5-04	**SPT-03**		5.05	5.50	**9.2**

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:_LAB_WATER CONTENT (REPORT) 2018 SJohn 16/8/20

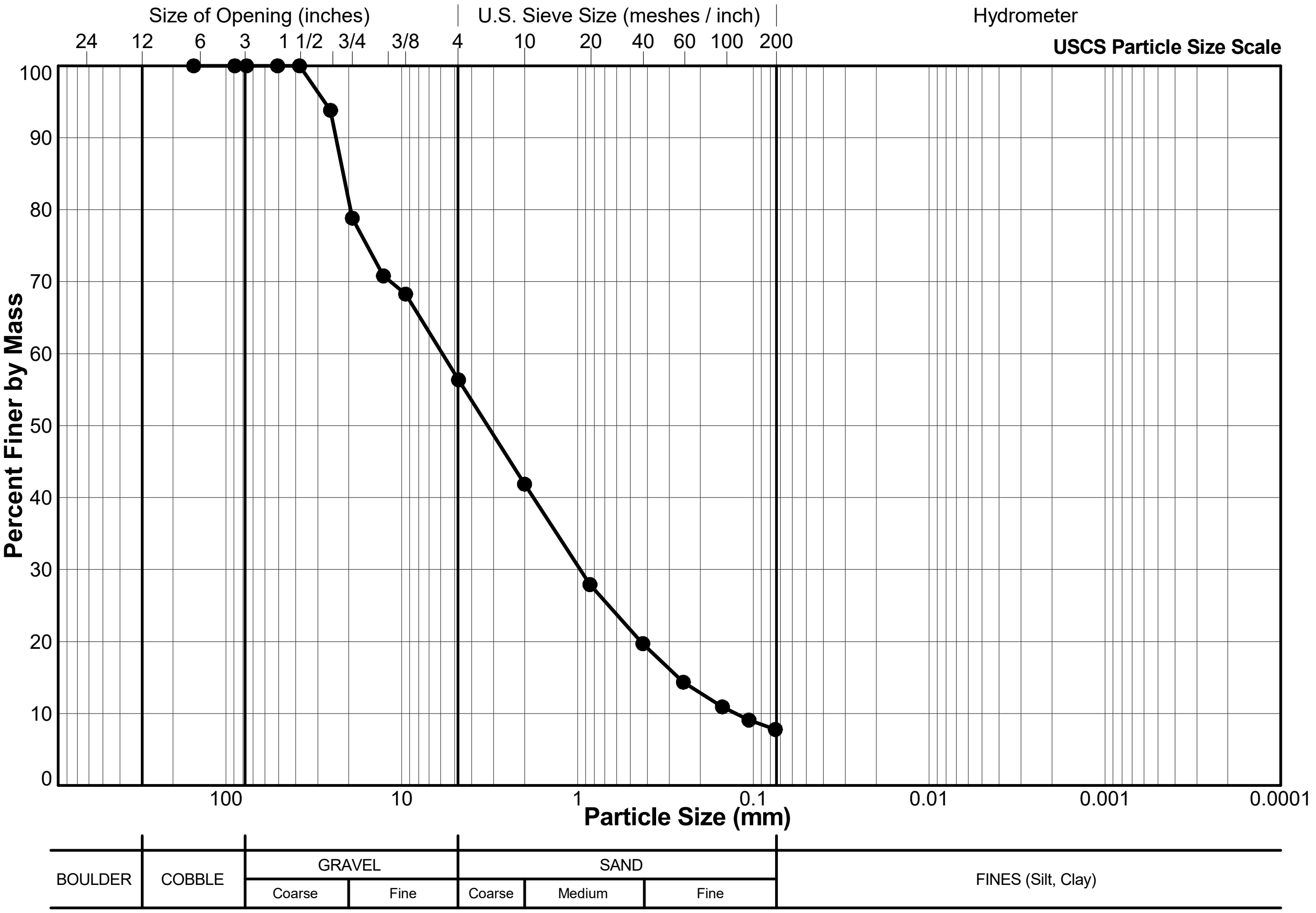
SJ	8/14/2020
Checked	Date

GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client:	BGC Engineering Inc.	**Sample Location:**	BH-BGC19-CW5-01
Project:	TMEP HDD Investigation; BGC Project No.: 1321150-14.13	**Sample No.:**	1
Location:	Not Given	**Depth Interval (m):**	2.89 to 3.30
Project No.:	19131807 **Phase:** 6000	**Lab Schedule No.:**	B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		93.8
3/4"	19.1		78.8
1/2"	12.7		70.8
3/8"	9.5		68.3
#4 US MESH	4.75		56.4
#10 US MESH	2		41.9
#20 US MESH	0.85		27.9
#40 US MESH	0.425		19.7
#60 US MESH	0.25		14.3
#100 US MESH	0.15		10.9
#140 US MESH	0.106		9.1
#200 US MESH	0.075		7.8

PE	1/2/2020	SJ	1/13/2020
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

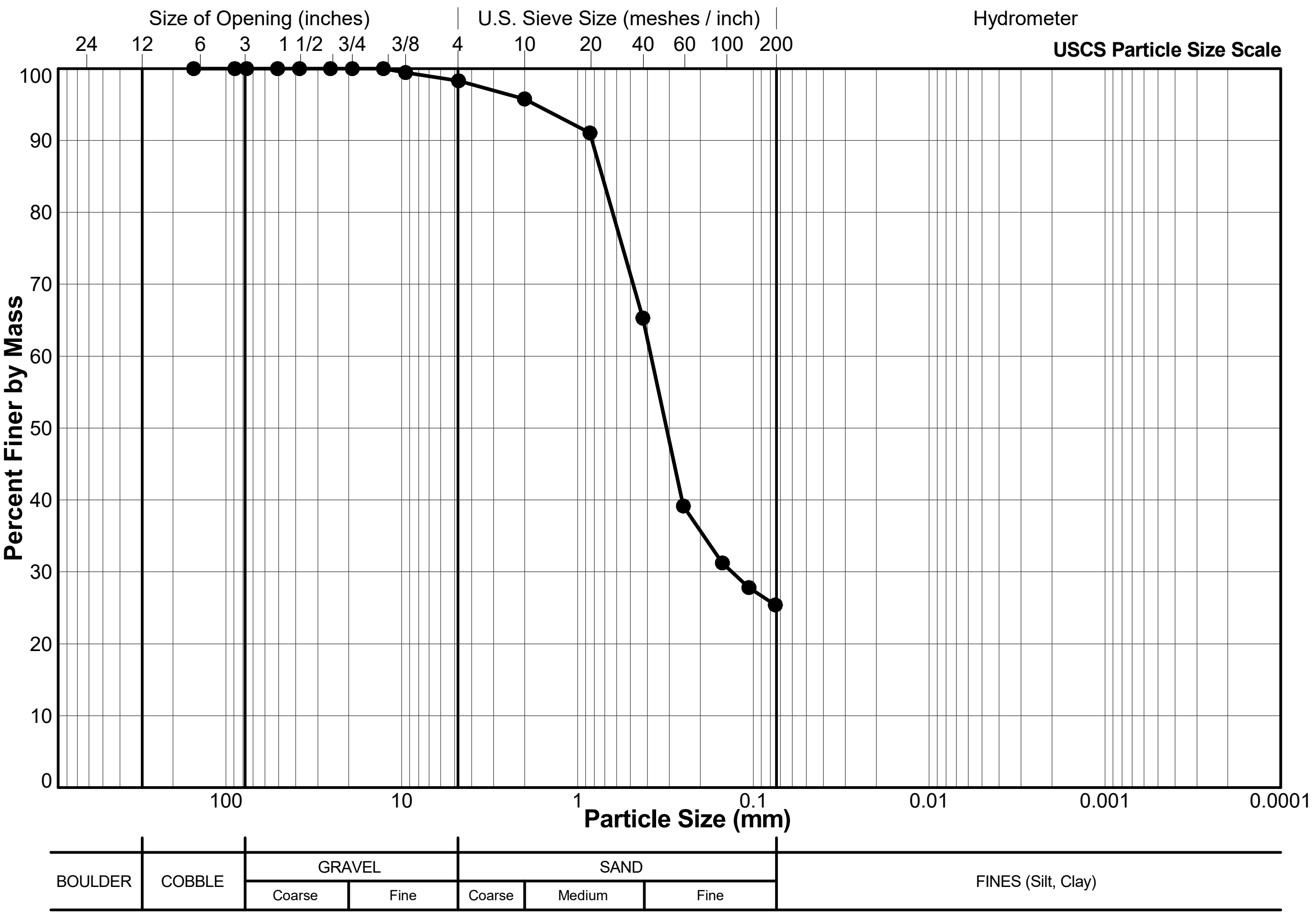
GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-01
Sample No.: 13
Depth Interval (m): 27.24 to 27.83
Lab Schedule No.: B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		99.5
#4 US MESH	4.75		98.3
#10 US MESH	2		95.8
#20 US MESH	0.85		91.1
#40 US MESH	0.425		65.3
#60 US MESH	0.25		39.2
#100 US MESH	0.15		31.2
#140 US MESH	0.106		27.8
#200 US MESH	0.075		25.4

PE	**1/2/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

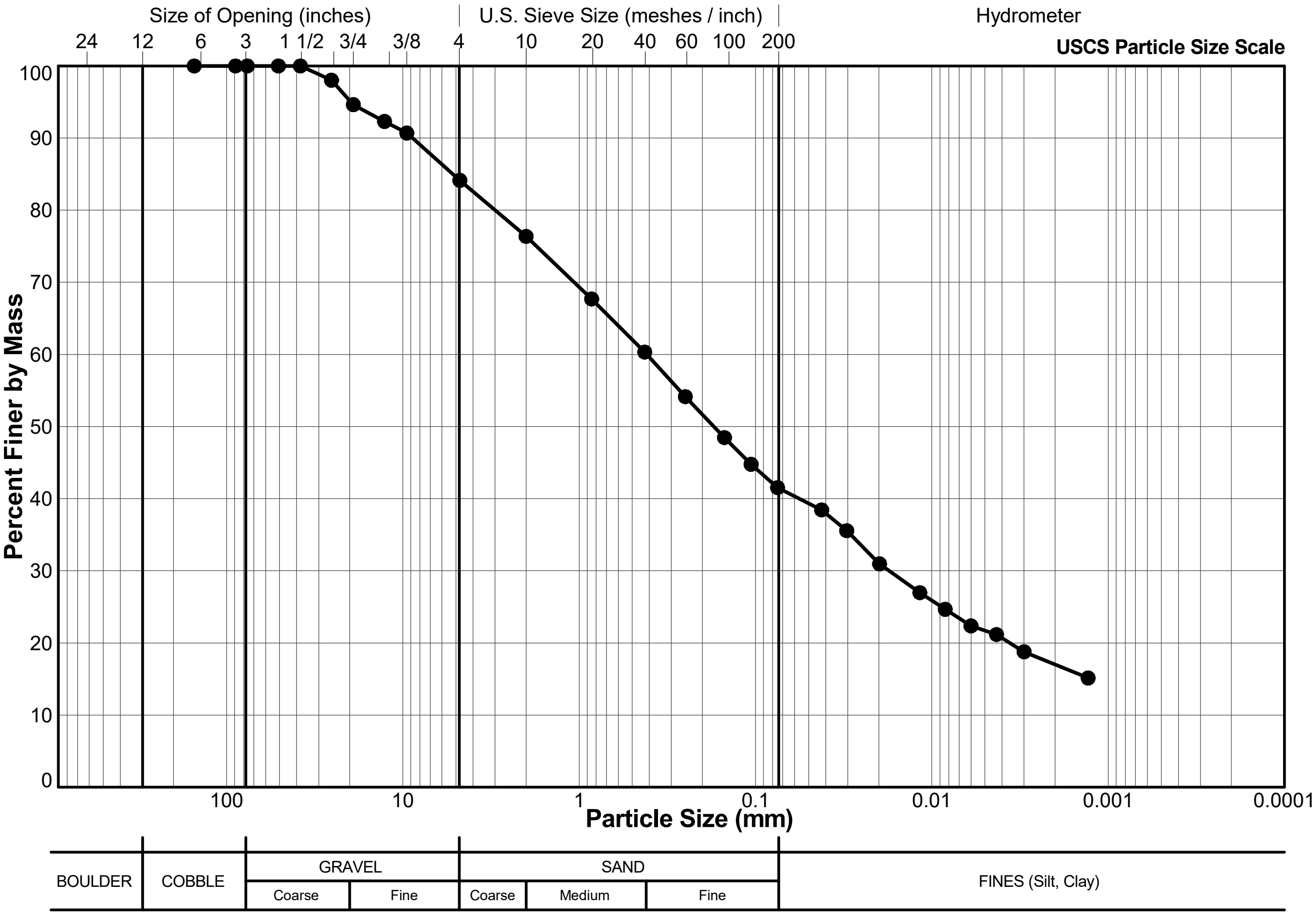
GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-01
Sample No.: 17
Depth Interval (m): 33.34 to 33.91
Lab Schedule No.: B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		98.0
3/4"	19.1		94.6
1/2"	12.7		92.3
3/8"	9.5		90.7
#4 US MESH	4.75		84.1
#10 US MESH	2		76.4
#20 US MESH	0.85		67.7
#40 US MESH	0.425		60.3
#60 US MESH	0.25		54.1
#100 US MESH	0.15		48.5
#140 US MESH	0.106		44.8
#200 US MESH	0.075		41.5
		0.0422	38.4
		0.0304	35.6
		0.0198	31.0
		0.0117	27.0
		0.0084	24.7
		0.0060	22.4
		0.0043	21.2
		0.0030	18.8
		0.0013	15.1

DC/VN	**1/7/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

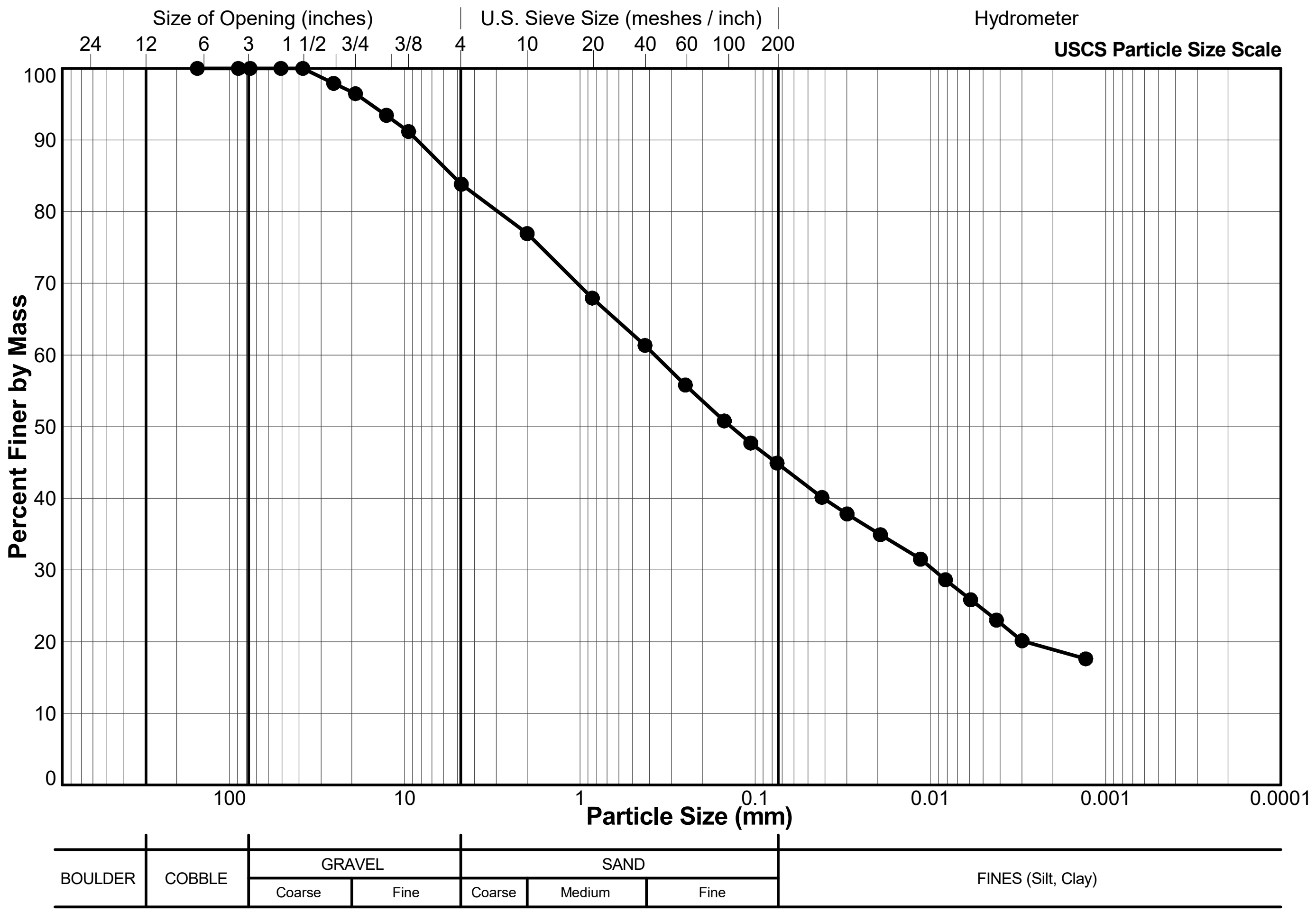
National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-01
Sample No.: 19
Depth Interval (m): 39.43 to 40.04
Lab Schedule No.: B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		97.9
3/4"	19.1		96.5
1/2"	12.7		93.5
3/8"	9.5		91.2
#4 US MESH	4.75		83.8
#10 US MESH	2		76.9
#20 US MESH	0.85		67.9
#40 US MESH	0.425		61.3
#60 US MESH	0.25		55.8
#100 US MESH	0.15		50.8
#140 US MESH	0.106		47.7
#200 US MESH	0.075		44.9
		0.0416	40.1
		0.0299	37.8
		0.0193	34.9
		0.0114	31.5
		0.0082	28.6
		0.0059	25.8
		0.0042	23.0
		0.0030	20.1
		0.0013	17.6

DC/VN	**1/7/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

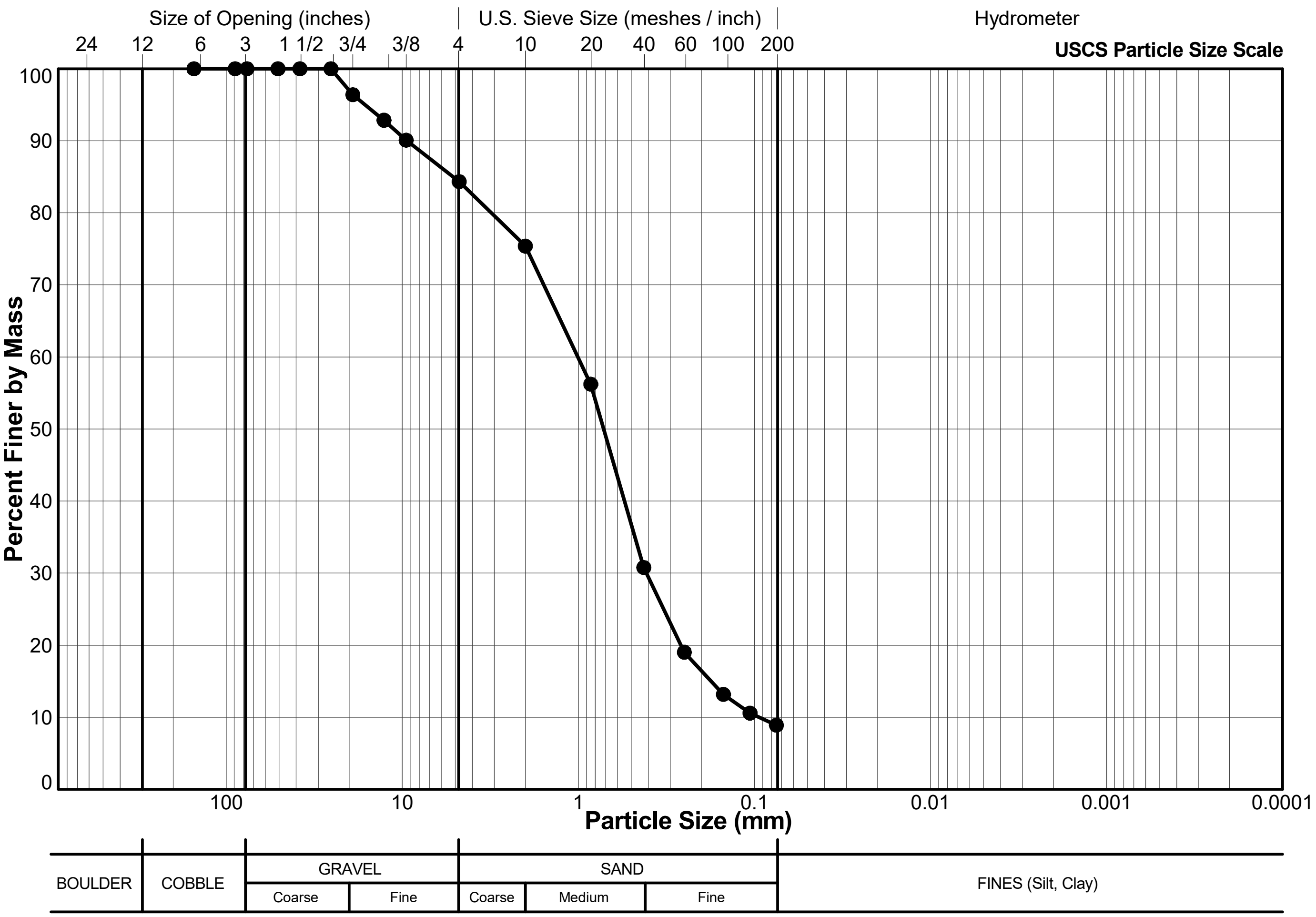
National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-03
Sample No.: 3
Depth Interval (m): 5.78 to 6.39
Lab Schedule No.: B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		96.4
1/2"	12.7		92.9
3/8"	9.5		90.1
#4 US MESH	4.75		84.3
#10 US MESH	2		75.4
#20 US MESH	0.85		56.2
#40 US MESH	0.425		30.8
#60 US MESH	0.25		19.0
#100 US MESH	0.15		13.2
#140 US MESH	0.106		10.6
#200 US MESH	0.075		8.9

PE	**1/2/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

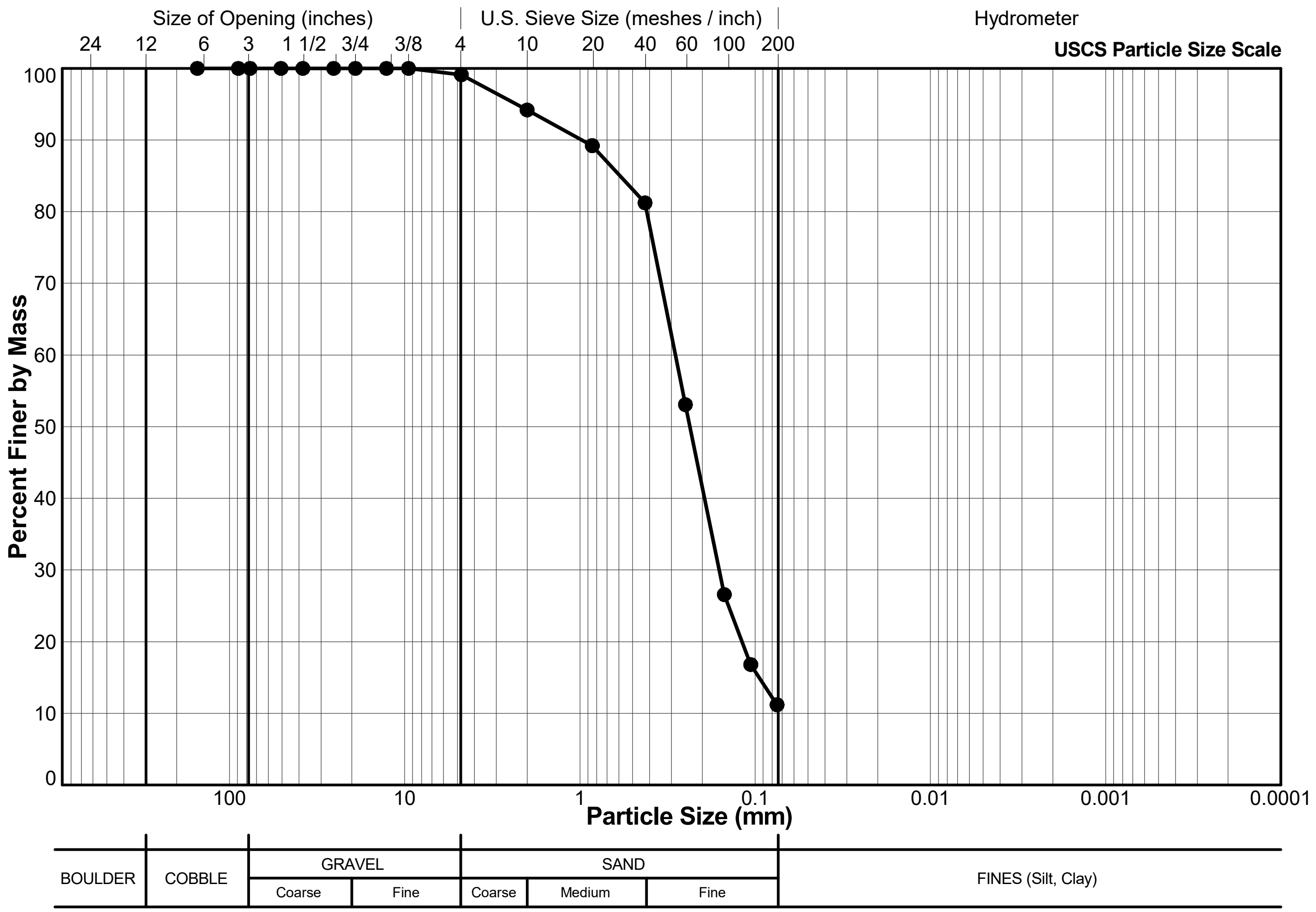
GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-03
Sample No.: 5
Depth Interval (m): 8.84 to 9.45
Lab Schedule No.: B19-417



Legend

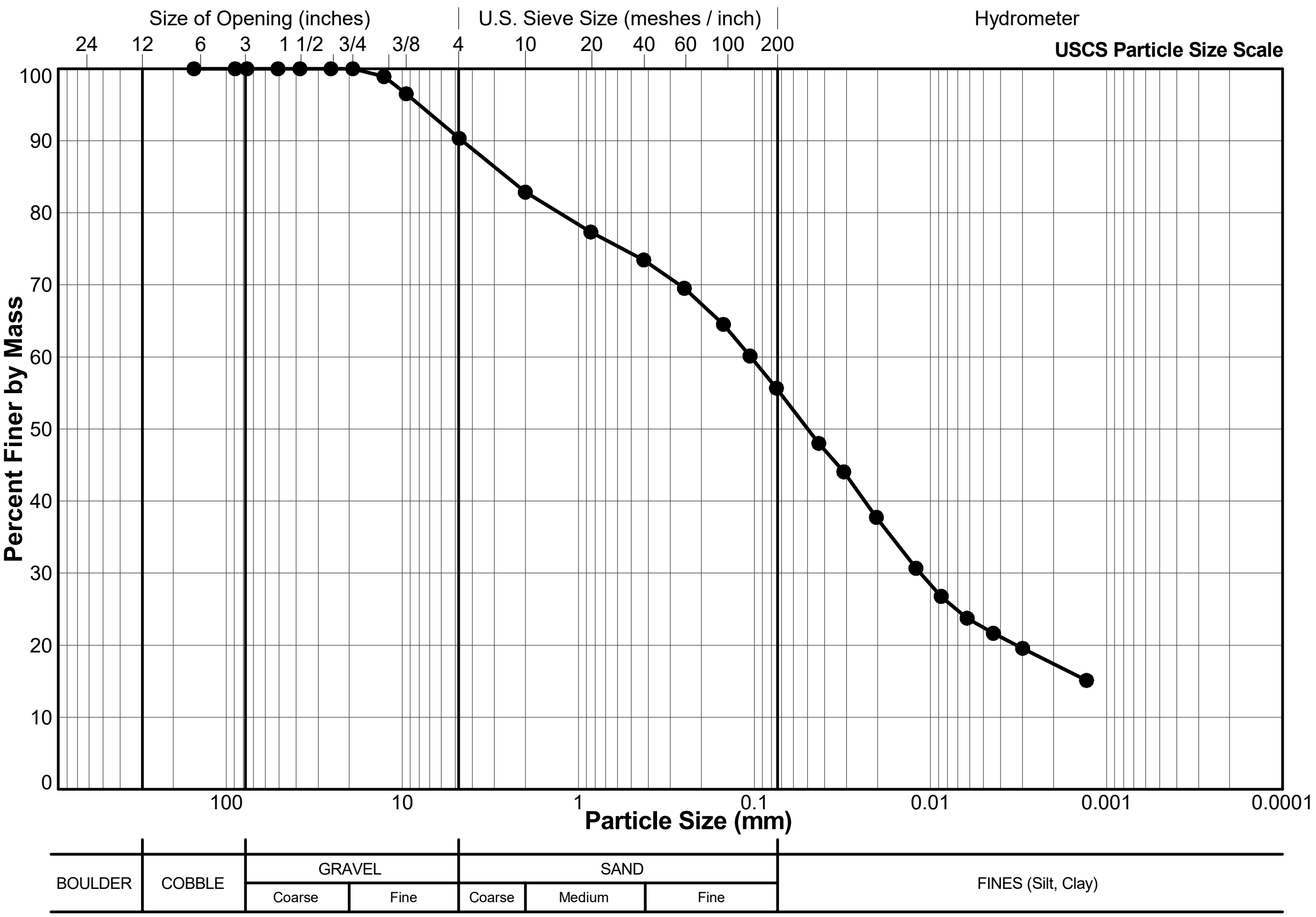
Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		99.1
#10 US MESH	2		94.2
#20 US MESH	0.85		89.2
#40 US MESH	0.425		81.2
#60 US MESH	0.25		53.1
#100 US MESH	0.15		26.6
#140 US MESH	0.106		16.8
#200 US MESH	0.075		11.2

PE	**1/2/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client:	BGC Engineering Inc.	**Sample Location:**	BH-BGC19-CW5-03
Project:	TMEP HDD Investigation; BGC Project No.: 1321150-14.13	**Sample No.:**	9
Location:	Not Given	**Depth Interval (m):**	14.93 to 15.21
Project No.:	19131807 **Phase:** 6000	**Lab Schedule No.:**	B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		98.9
3/8"	9.5		96.5
#4 US MESH	4.75		90.3
#10 US MESH	2		82.9
#20 US MESH	0.85		77.3
#40 US MESH	0.425		73.5
#60 US MESH	0.25		69.5
#100 US MESH	0.15		64.5
#140 US MESH	0.106		60.1
#200 US MESH	0.075		55.7
		0.0431	48.0
		0.0311	44.1
		0.0203	37.7
		0.0121	30.7
		0.0087	26.8
		0.0062	23.8
		0.0044	21.7
		0.0030	19.6
		0.0013	15.1

PE/KS	**1/6/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

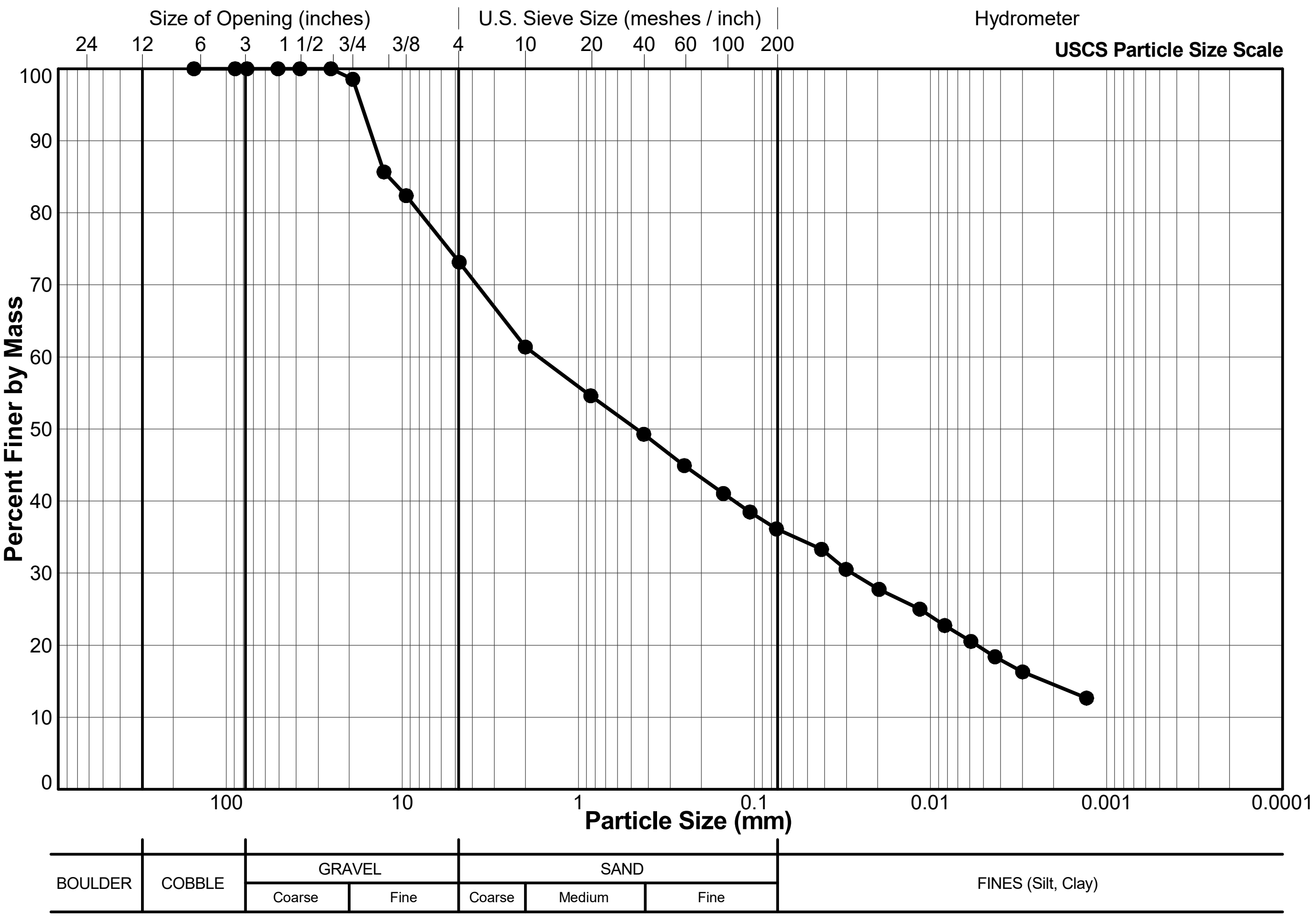
National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-03
Sample No.: 14
Depth Interval (m): 27.14 to 27.51
Lab Schedule No.: B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		98.5
1/2"	12.7		85.7
3/8"	9.5		82.4
#4 US MESH	4.75		73.2
#10 US MESH	2		61.4
#20 US MESH	0.85		54.6
#40 US MESH	0.425		49.3
#60 US MESH	0.25		44.9
#100 US MESH	0.15		41.0
#140 US MESH	0.106		38.5
#200 US MESH	0.075		36.1
		0.0416	33.3
		0.0302	30.5
		0.0196	27.7
		0.0115	25.0
		0.0083	22.7
		0.0059	20.5
		0.0043	18.4
		0.0030	16.3
		0.0013	12.7

PE/KS	**1/6/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

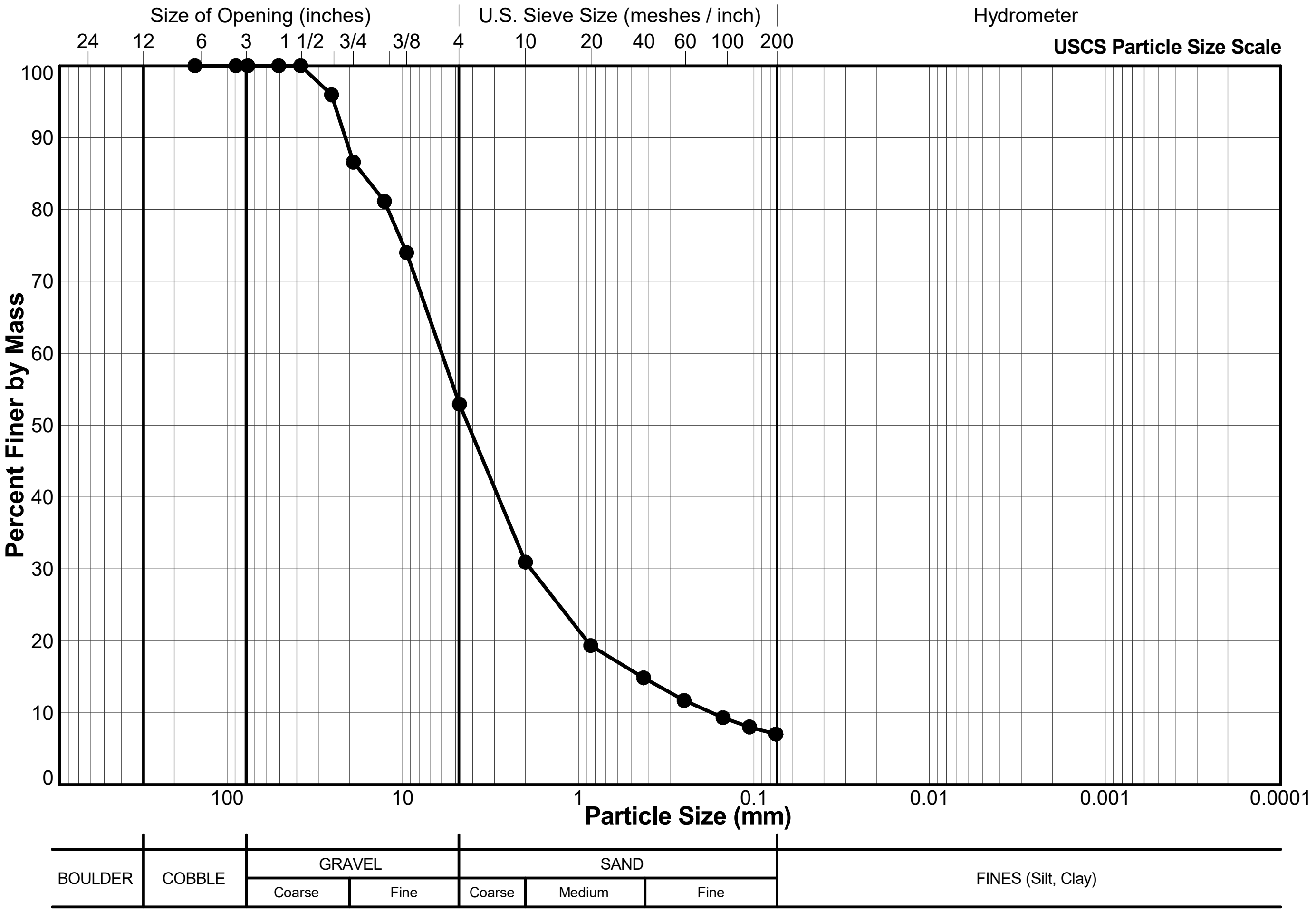
National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D6913

Client: BGC Engineering Inc.
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Location: Not Given
Project No.: 19131807 **Phase:** 6000

Sample Location: BH-BGC19-CW5-03
Sample No.: 18
Depth Interval (m): 39.33 to 39.59
Lab Schedule No.: B19-417



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		96.0
3/4"	19.1		86.6
1/2"	12.7		81.1
3/8"	9.5		74.0
#4 US MESH	4.75		52.9
#10 US MESH	2		30.9
#20 US MESH	0.85		19.3
#40 US MESH	0.425		14.9
#60 US MESH	0.25		11.7
#100 US MESH	0.15		9.3
#140 US MESH	0.106		8.0
#200 US MESH	0.075		7.0

PE	**1/2/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

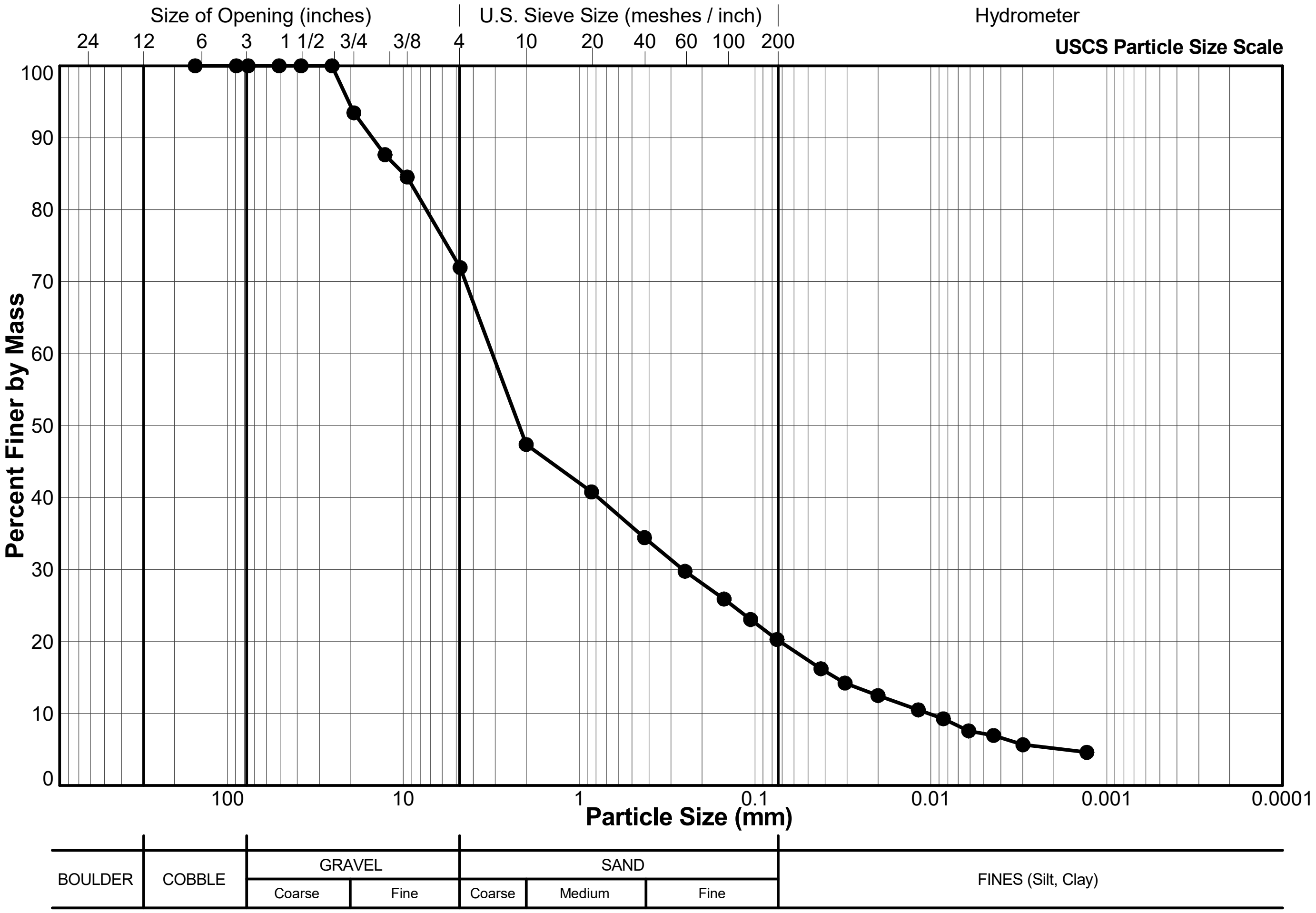
National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2433 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 15/1/20

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP CWIR South; BGC Project No.: 1321150-43.04
Location: Not Given
Project No.: 19131807 **Phase:** 18000

Sample Location: BH-BGC20-CW5-02
Sample No.: SPT-03
Depth Interval (m): 4.70 to 5.15
Lab Schedule No.: B20-264



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		93.5
1/2"	12.7		87.6
3/8"	9.5		84.5
#4 US MESH	4.75		72.0
#10 US MESH	2		47.4
#20 US MESH	0.85		40.8
#40 US MESH	0.425		34.4
#60 US MESH	0.25		29.8
#100 US MESH	0.15		25.9
#140 US MESH	0.106		23.1
#200 US MESH	0.075		20.3
		0.0422	16.2
		0.0308	14.2
		0.0200	12.5
		0.0118	10.5
		0.0085	9.3
		0.0061	7.6
		0.0044	7.0
		0.0030	5.7
		0.0013	4.6

KS/NE	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

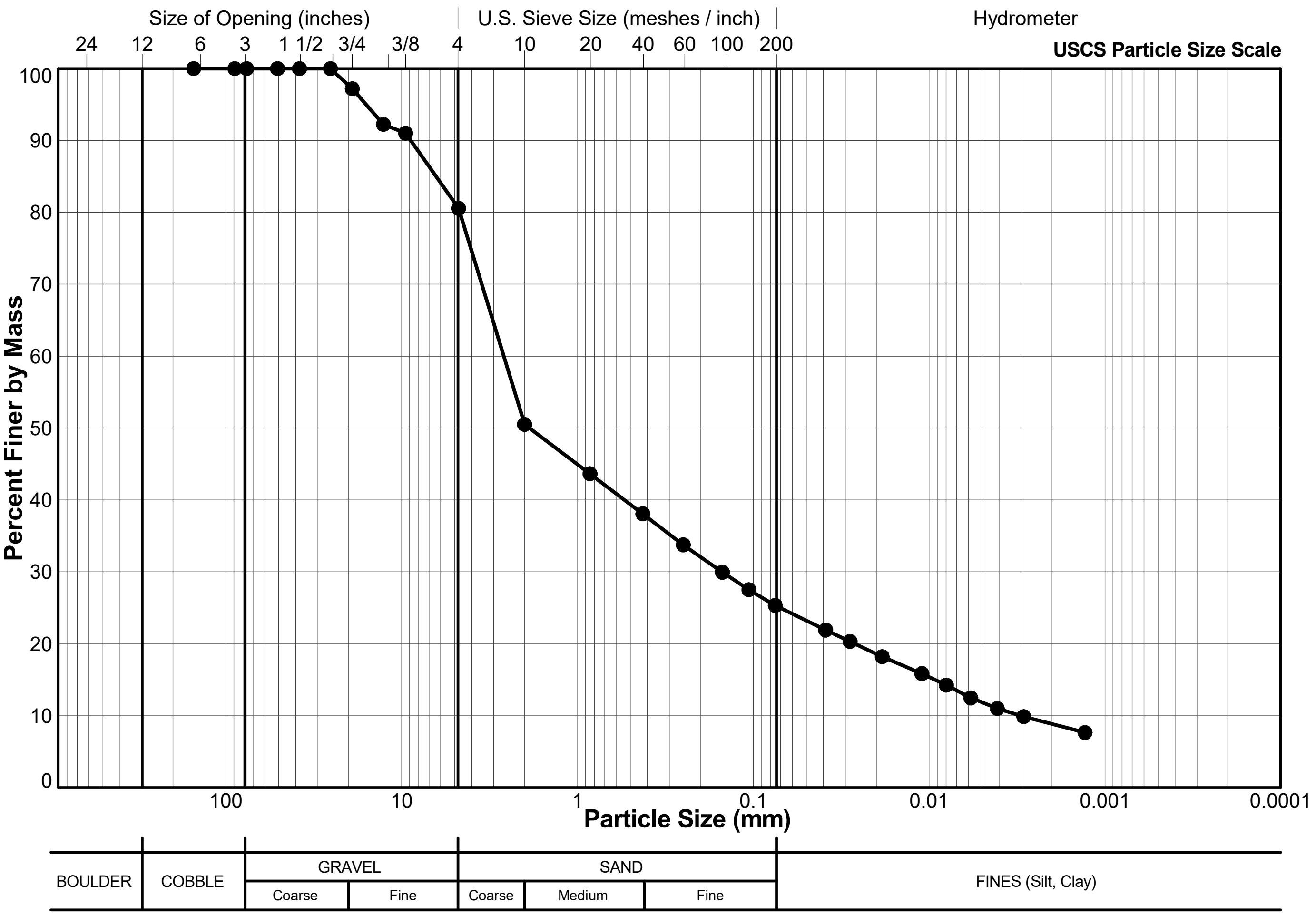
National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2596 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 16/8/20

GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client:	BGC Engineering Inc.	**Sample Location:**	BH-BGC20-CW5-02
Project:	TMEP CWIR South; BGC Project No.: 1321150-43.04	**Sample No.:**	SPT-06
Location:	Not Given	**Depth Interval (m):**	9.30 to 9.73
Project No.:	19131807 **Phase:** 18000	**Lab Schedule No.:**	B20-264



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		97.2
1/2"	12.7		92.2
3/8"	9.5		91.0
#4 US MESH	4.75		80.6
#10 US MESH	2		50.5
#20 US MESH	0.85		43.7
#40 US MESH	0.425		38.1
#60 US MESH	0.25		33.8
#100 US MESH	0.15		30.0
#140 US MESH	0.106		27.5
#200 US MESH	0.075		25.3
		0.0388	21.9
		0.0282	20.3
		0.0185	18.2
		0.0110	15.8
		0.0080	14.3
		0.0058	12.5
		0.0041	11.0
		0.0029	9.9
		0.0013	7.7

KS/NE	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

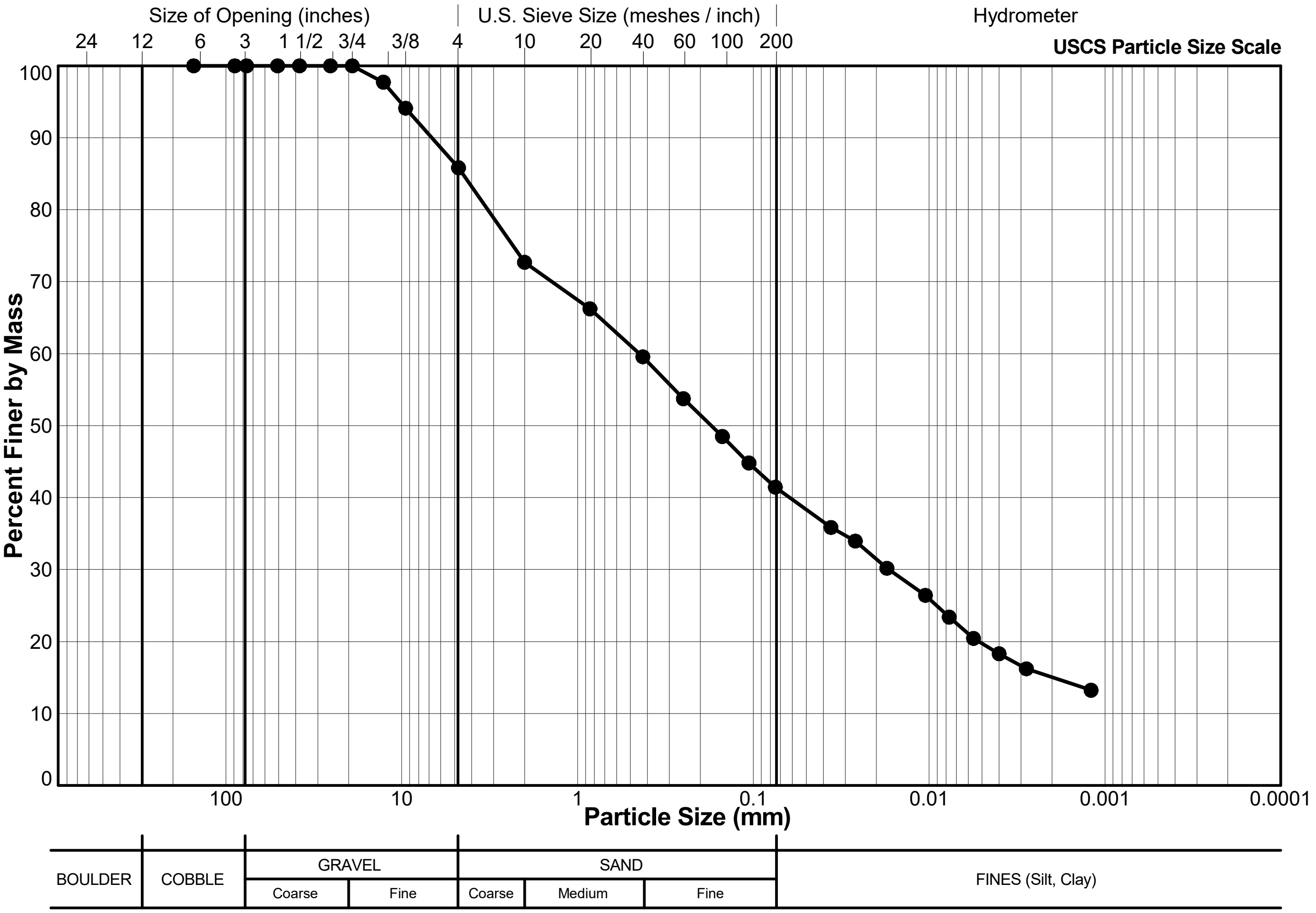
GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP CWIR South; BGC Project No.: 1321150-43.04
Location: Not Given
Project No.: 19131807 **Phase:** 18000

Sample Location: BH-BGC20-CW5-02
Sample No.: SPT-10
Depth Interval (m): 17.06 to 17.41
Lab Schedule No.: B20-264



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		97.7
3/8"	9.5		94.1
#4 US MESH	4.75		85.8
#10 US MESH	2		72.7
#20 US MESH	0.85		66.2
#40 US MESH	0.425		59.6
#60 US MESH	0.25		53.7
#100 US MESH	0.15		48.5
#140 US MESH	0.106		44.8
#200 US MESH	0.075		41.4
		0.0362	35.8
		0.0263	34.0
		0.0174	30.2
		0.0105	26.4
		0.0077	23.4
		0.0056	20.4
		0.0040	18.3
		0.0028	16.2
		0.0012	13.2

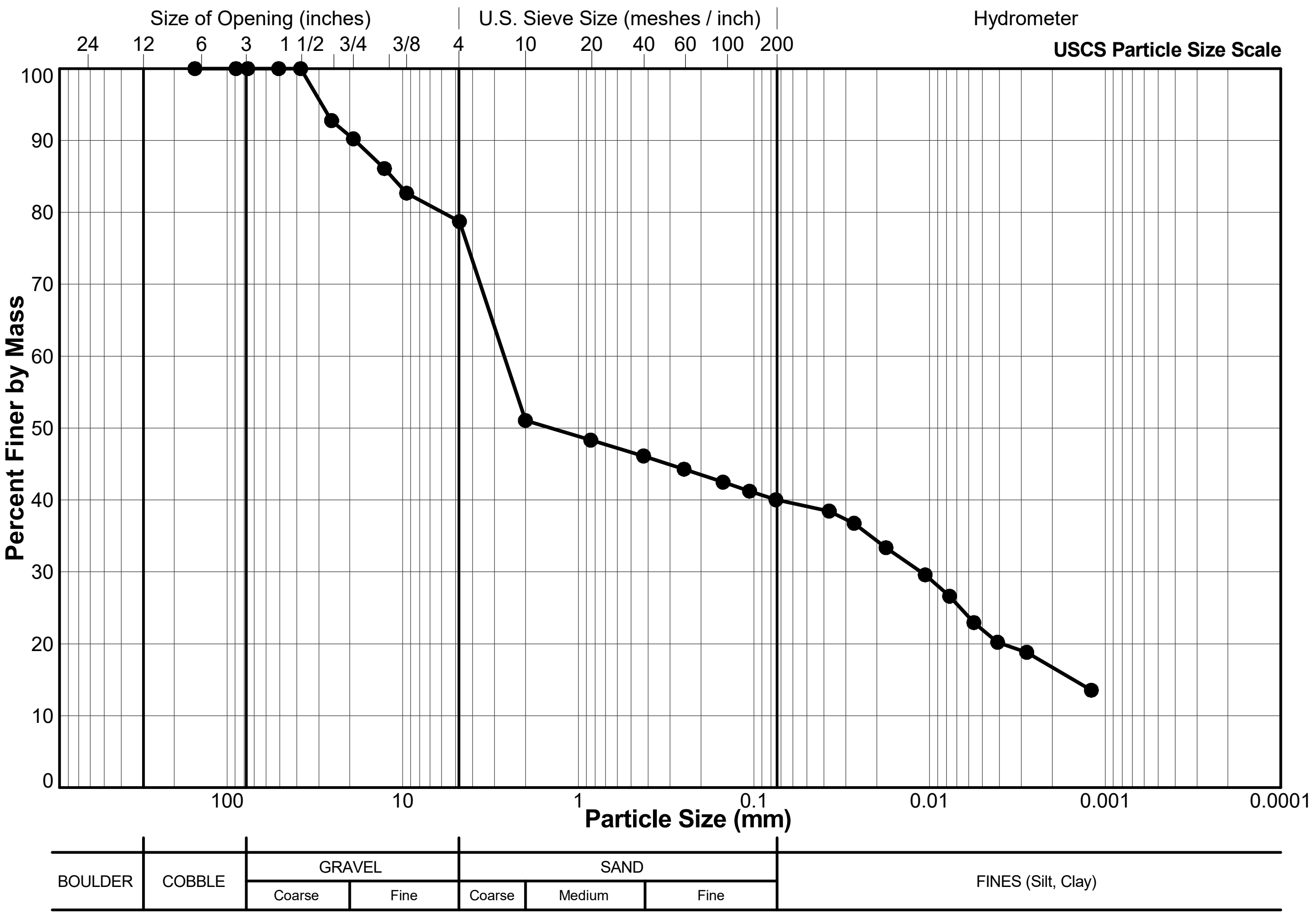
KS/NE	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2596 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 16/8/20

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client:	BGC Engineering Inc.	**Sample Location:**	BH-BGC20-CW5-02
Project:	TMEP CWIR South; BGC Project No.: 1321150-43.04	**Sample No.:**	SPT-15
Location:	Not Given	**Depth Interval (m):**	29.13 to 29.58
Project No.:	19131807 **Phase:** 18000	**Lab Schedule No.:**	B20-264



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		92.8
3/4"	19.1		90.2
1/2"	12.7		86.1
3/8"	9.5		82.7
#4 US MESH	4.75		78.7
#10 US MESH	2		51.1
#20 US MESH	0.85		48.3
#40 US MESH	0.425		46.1
#60 US MESH	0.25		44.3
#100 US MESH	0.15		42.5
#140 US MESH	0.106		41.2
#200 US MESH	0.075		40.0
		0.0373	38.5
		0.0269	36.8
		0.0177	33.4
		0.0106	29.6
		0.0077	26.6
		0.0056	23.0
		0.0041	20.2
		0.0028	18.8
		0.0012	13.5

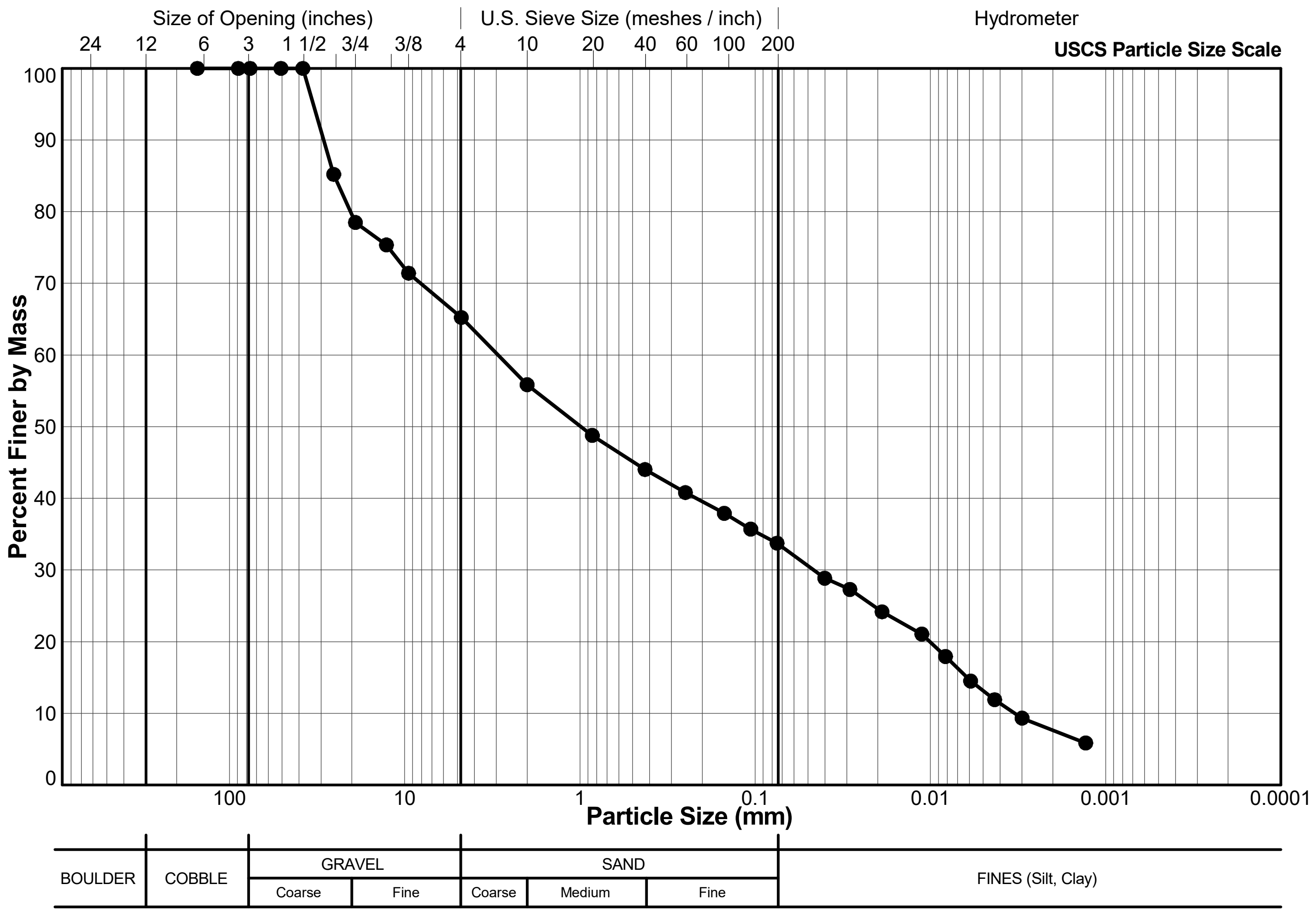
KS/NE	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP CWIR South; BGC Project No.: 1321150-43.04
Location: Not Given
Project No.: 19131807 **Phase:** 18000

Sample Location: BH-BGC20-CW5-04
Sample No.: SPT-01
Depth Interval (m): 1.60 to 2.05
Lab Schedule No.: B20-264



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		85.2
3/4"	19.1		78.5
1/2"	12.7		75.4
3/8"	9.5		71.4
#4 US MESH	4.75		65.2
#10 US MESH	2		55.9
#20 US MESH	0.85		48.8
#40 US MESH	0.425		44.0
#60 US MESH	0.25		40.8
#100 US MESH	0.15		37.9
#140 US MESH	0.106		35.7
#200 US MESH	0.075		33.7
		0.0401	28.9
		0.0288	27.3
		0.0189	24.2
		0.0112	21.1
		0.0082	17.9
		0.0059	14.5
		0.0043	11.9
		0.0030	9.3
		0.0013	5.9

KS/NE	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:2596 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) 2018 SJohn 16/8/20

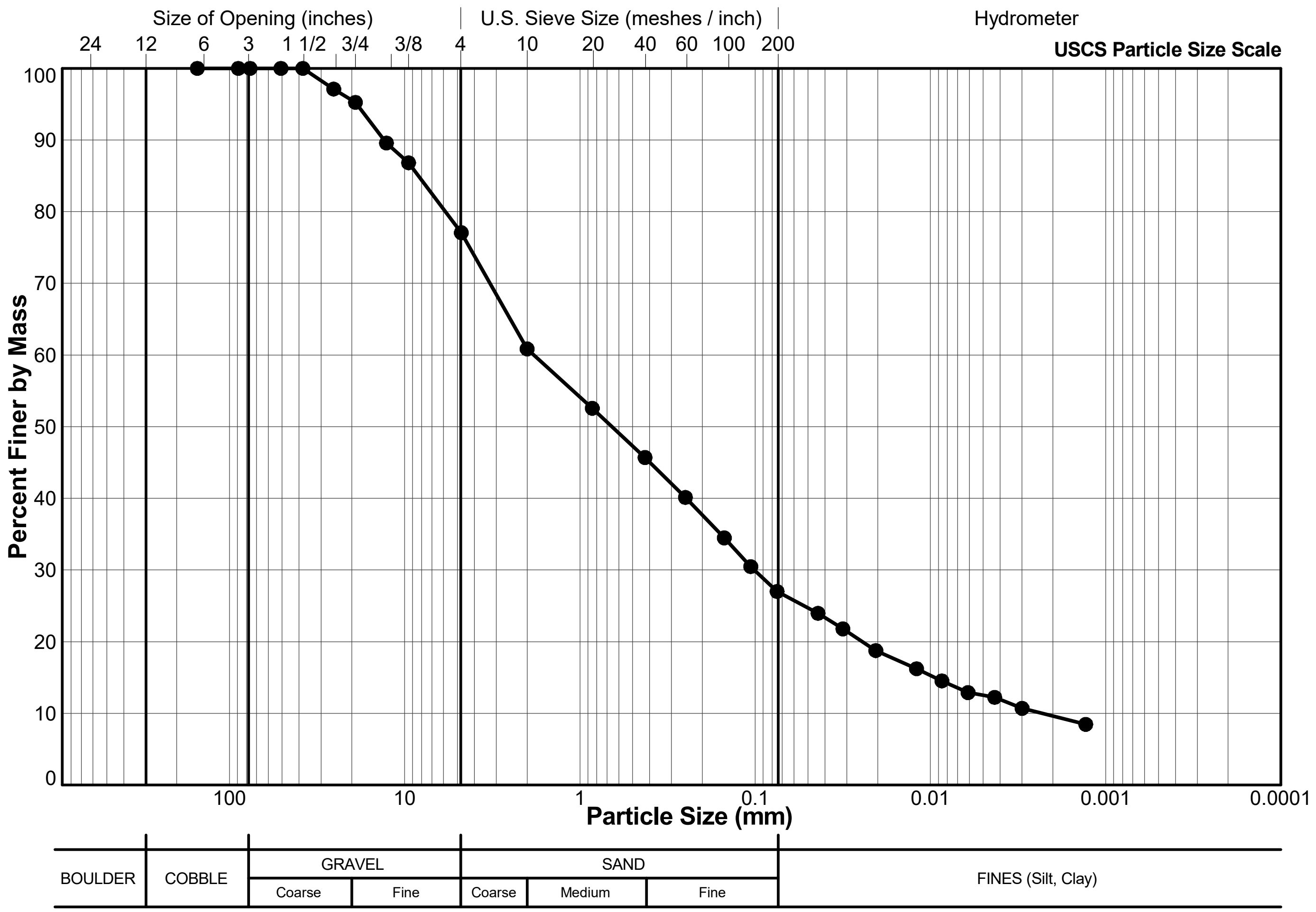
GOLDER

SUMMARY OF PARTICLE SIZE DISTRIBUTION

ASTM D 422

Client: BGC Engineering Inc.
Project: TMEP CWIR South; BGC Project No.: 1321150-43.04
Location: Not Given
Project No.: 19131807 **Phase:** 18000

Sample Location: BH-BGC20-CW5-04
Sample No.: SPT-03
Depth Interval (m): 5.05 to 5.50
Lab Schedule No.: B20-264



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		97.1
3/4"	19.1		95.3
1/2"	12.7		89.6
3/8"	9.5		86.8
#4 US MESH	4.75		77.1
#10 US MESH	2		60.8
#20 US MESH	0.85		52.6
#40 US MESH	0.425		45.7
#60 US MESH	0.25		40.1
#100 US MESH	0.15		34.5
#140 US MESH	0.106		30.5
#200 US MESH	0.075		27.0
		0.0438	24.0
		0.0316	21.8
		0.0205	18.8
		0.0120	16.2
		0.0086	14.5
		0.0061	12.9
		0.0043	12.2
		0.0030	10.7
		0.0013	8.5

KS/NE	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

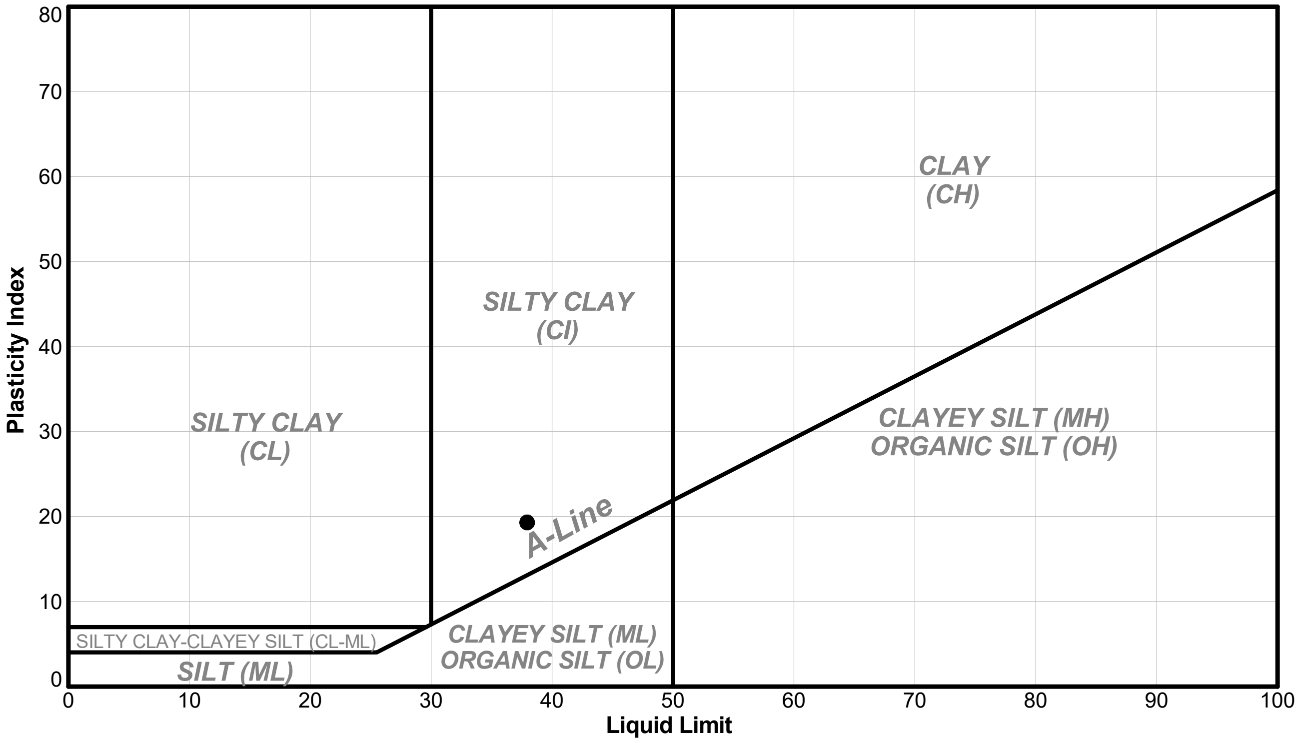
ASTM D 4318

Client: BGC Engineering Inc.
ID: BH-BGC19-CW5-01
Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13
Sample No.: 4
Location: Not Given
Depth Interval (m): 7.50 to 8.11
Project No.: 19131807 **Phase:** 6000
Lab Schedule No.: B19-417

Other Remarks: **N/A**

Test Method: A-Multi Point
Preparation Method: Air Dried

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	BH-BGC19-CW5-01	4	7.50	8.11	ND	38	19	19.0	34.8	0.8

NP - NON-PLASTIC RESULT   ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

KM/RG	**1/6/2020**	**SJ**	**1/13/2020**
Tech	Date	Checked	Date

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

ASTM D 4318

Client: BGC Engineering Inc.

Project: TMEP HDD Investigation; BGC Project No.: 1321150-14.13

Location: Not Given

Project No.: 19131807 **Phase:** 6000

ID: **BH-BGC19-CW5-03**

Sample No.: **13**

Depth Interval (m): 24.09 to 24.70

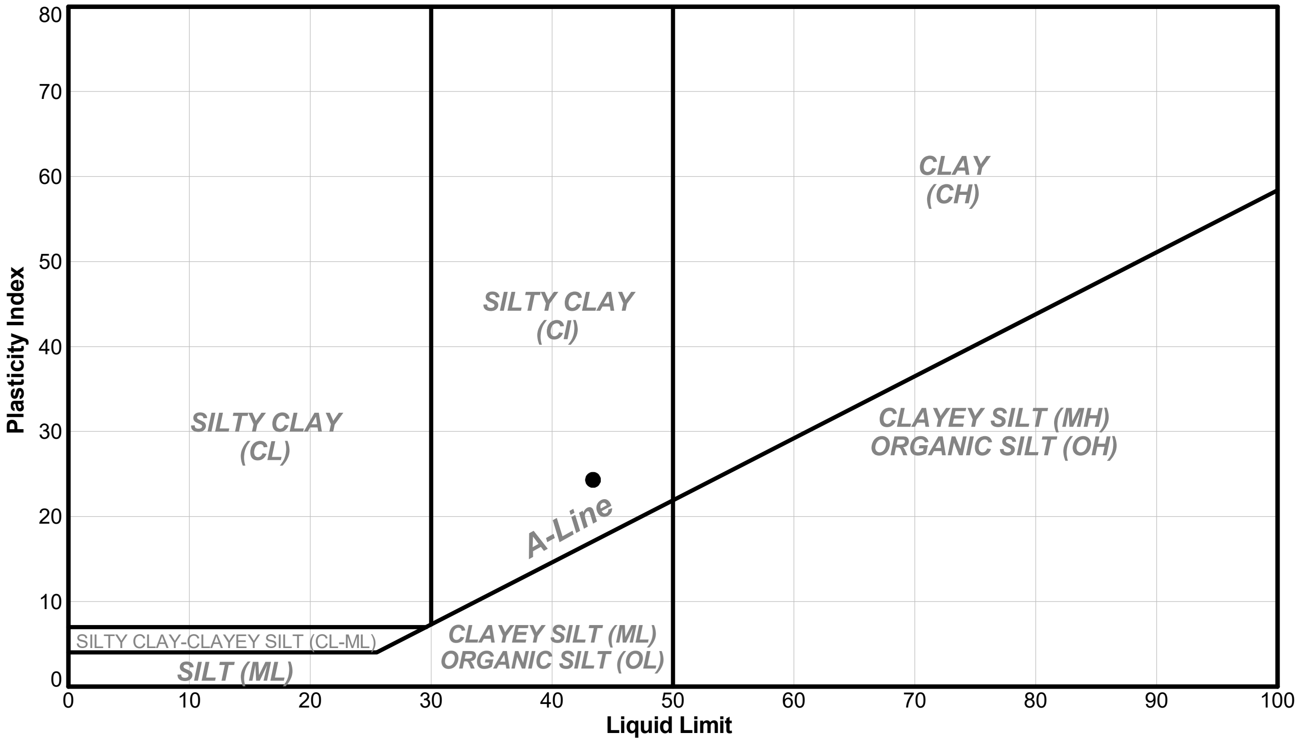
Lab Schedule No.: B19-417

Other Remarks: **N/A**

Test Method: A-Multi Point

Preparation Method: Air Dried

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	BH-BGC19-CW5-03	13	24.09	24.70	ND	43	19	24.0	22.3	0.1

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

RG	1/8/2020	SJ	1/13/2020
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:_LAB ATTERBERG CASAGRANDE (SINGLE) 2018 SJohn 15/1/20

GOLDER

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

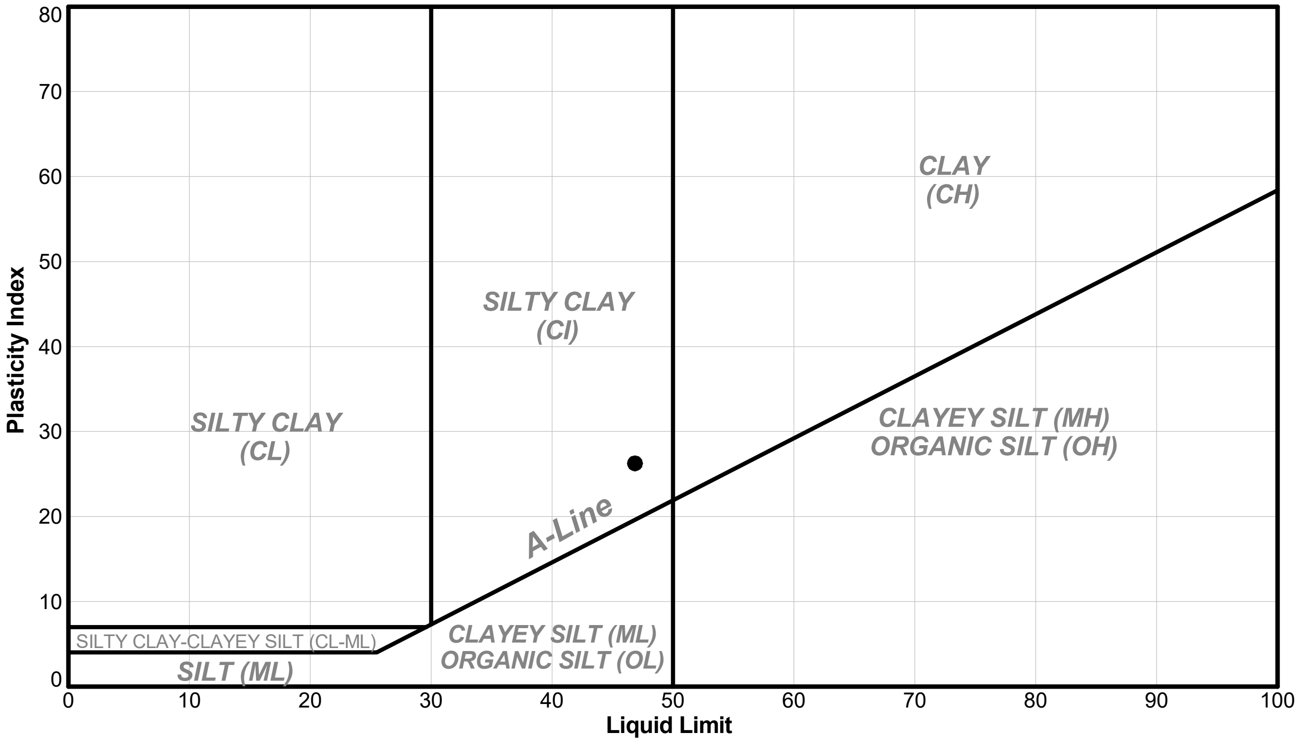
ASTM D 4318

Client:	BGC Engineering Inc.	**ID:**	**BH-BGC20-CW5-02**
Project:	TMEP CWIR South; BGC Project No.: 1321150-43.04	**Sample No.:**	**SPT-13**
Location:	Not Given	**Depth Interval (m):**	24.56 to 25.01
Project No.:	19131807 **Phase:** 18000	**Lab Schedule No.:**	B20-264

Other Remarks: **N/A**

Test Method: A-Multi Point | **Preparation Method: Wet**

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	BH-BGC20-CW5-02	SPT-13	24.56	25.01	ND	47	21	26.0	25.2	0.2

NP - NON-PLASTIC RESULT   ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

FF	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:_LAB ATTERBERG CASAGRANDE (SINGLE) 2018 SJohn 16/8/20

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

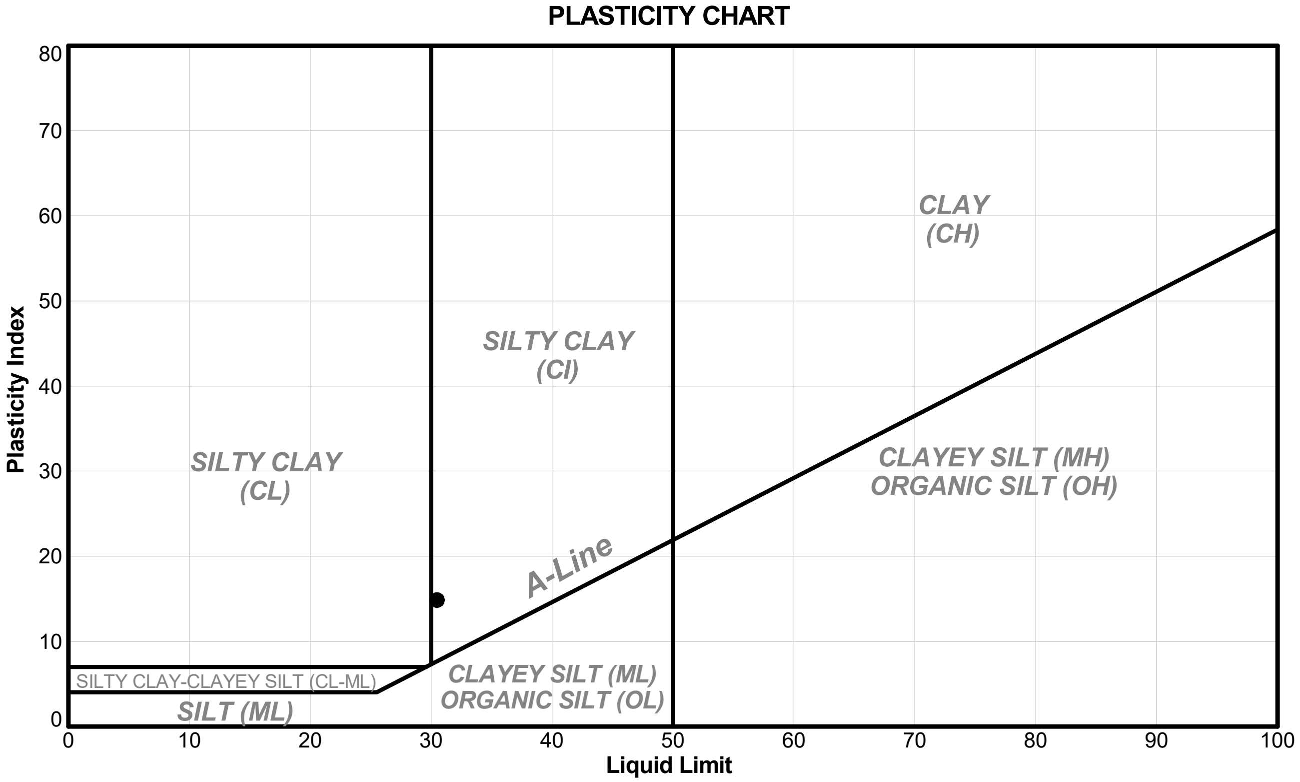
ASTM D 4318

Client: BGC Engineering Inc.
Project: TMEP CWIR South; BGC Project No.: 1321150-43.04
Location: Not Given
Project No.: 19131807 **Phase:** 18000

ID: BH-BGC20-CW5-02
Sample No.: SPT-15
Depth Interval (m): 29.13 to 29.58
Lab Schedule No.: B20-264

Other Remarks: N/A

Test Method: A-Multi Point | **Preparation Method: Air Dried**



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	BH-BGC20-CW5-02	SPT-15	29.13	29.58	46	30	16	14.0	15.2	-0.1

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

FF	8/10/2020	SJ	8/14/2020
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:_LAB ATTERBERG CASAGRANDE (SINGLE) 2018 SJohn 16/8/20

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

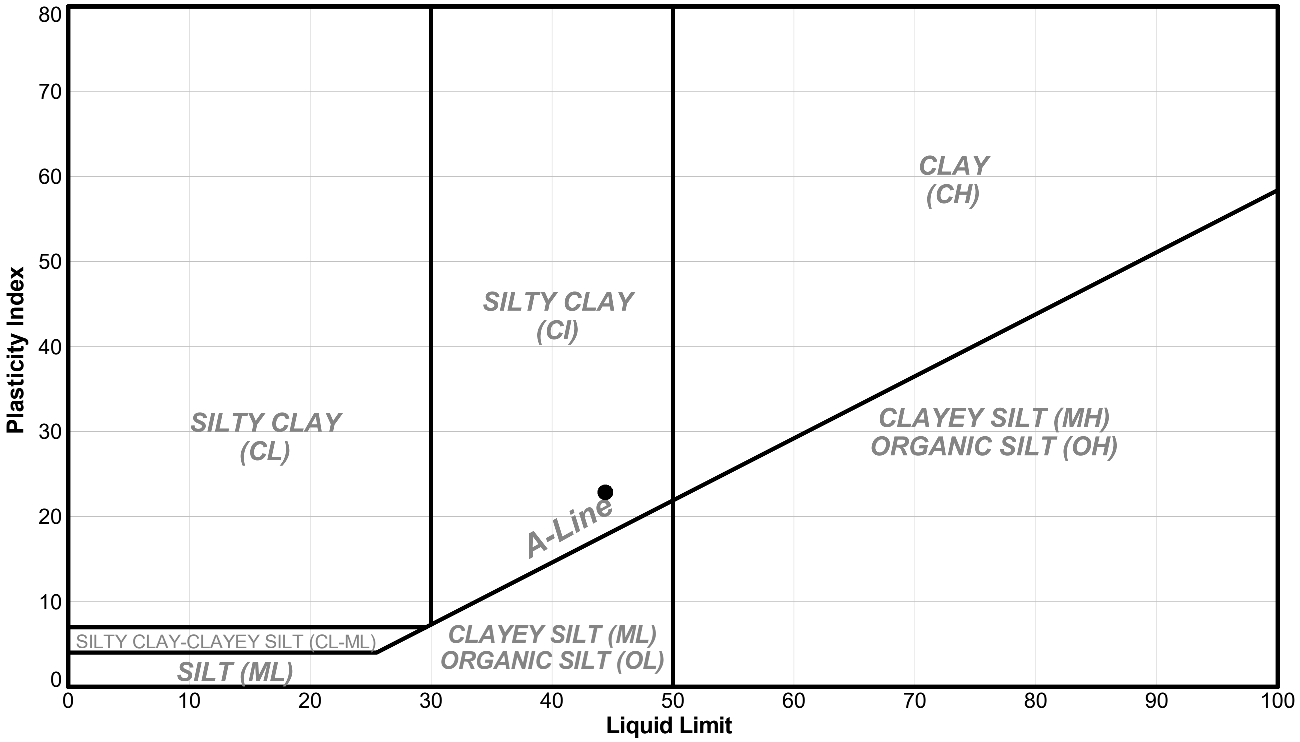
ASTM D 4318

Client:	BGC Engineering Inc.	**ID:**	**BH-BGC20-CW5-02**
Project:	TMEP CWIR South; BGC Project No.: 1321150-43.04	**Sample No.:**	**SPT-17**
Location:	Not Given	**Depth Interval (m):**	35.46 to 35.91
Project No.:	19131807 **Phase:** 18000	**Lab Schedule No.:**	B20-264

Other Remarks: **N/A**

Test Method: A-Multi Point | **Preparation Method: Wet**

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	BH-BGC20-CW5-02	SPT-17	35.46	35.91	ND	44	22	22.0	28.5	0.3

NP - NON-PLASTIC RESULT   ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

FF	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

Golder Associates Ltd.
300 - 3811 North Fraser Way, Burnaby, BC V5J 5J2 CANADA
Tel: +1 (604) 412 6899 Fax: +1 (604) 412 6816 www.golder.com

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

ASTM D 4318

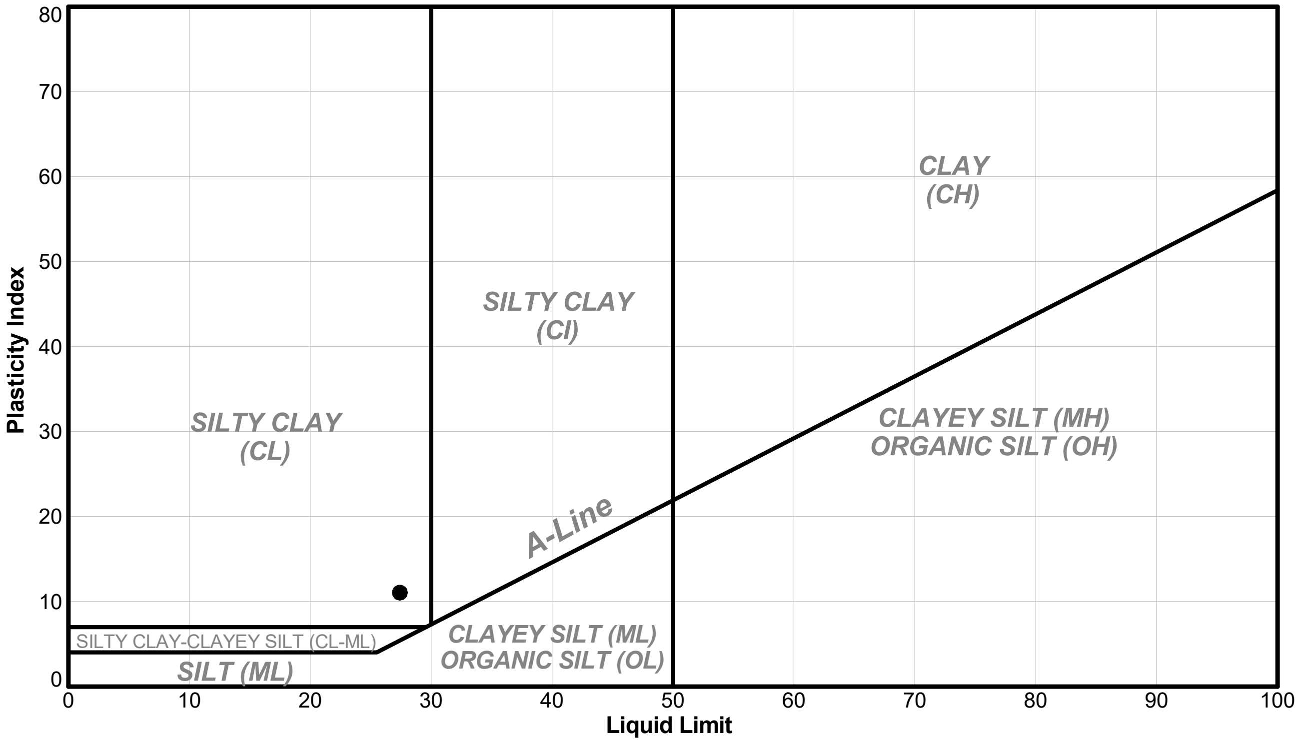
Client: BGC Engineering Inc.
Project: TMEP CWIR South; BGC Project No.: 1321150-43.04
Location: Not Given
Project No.: 19131807 **Phase:** 18000

ID: BH-BGC20-CW5-04
Sample No.: SPT-01
Depth Interval (m): 1.60 to 2.05
Lab Schedule No.: B20-264

Other Remarks: N/A

Test Method: A-Multi Point
Preparation Method: Air Dried

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	BH-BGC20-CW5-04	SPT-01	1.60	2.05	44	27	16	11.0	16.2	0.0

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

FF	**8/10/2020**	**SJ**	**8/14/2020**
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID: Output Form:_LAB ATTERBERG CASAGRANDE (SINGLE) 2018 SJohn 16/8/20

Laboratory Determination of Uniaxial Compressive Strength of Intact Rock Core Specimens

Summary of Test Results

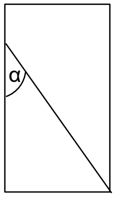
ASTM D7012 Method C

Project No.: 19131807-18000
Project: TMEP CWIR South
Location: Not Provided
Client: BGC Engineering Inc.
Lab ID No: B20-264

Failure Modes
(1) Simple Extension
(2) Multiple Extension
(3) Multiple Fracturing
(4) Multiple Shear
(5) Single Shear
(6) Spalling
(7) Other

* Wet density based on as received moisture

Note: Alpha angle, α, measured relative to the core axis



No.	Borehole #	Sample #	Depth (m)	Dia (mm)	Ht (mm)	Area (cm²)	Volume (cm³)	Mass (g)	* Wet Density (kg/m³)	Moisture (%)	Dry Density (kg/m³)	Maximum Load (kN)	Stress σ_u (MPa)	Rock Type	Failure Mode	
															Type	α (deg)
1	BH-BGC20-CW5-02	UCS-1	47.71-47.96	60.92	138.33	29.15	403.21	1012.40	2511	1.15	2482	264.50	90.7	Not Provided	3/6	N/A
2	BH-BGC20-CW5-02	UCS-2	49.18-49.40	60.95	137.99	29.18	402.61	1007.50	2502	1.38	2468	112.10	38.4	Not Provided	5*	28
3	BH-BGC20-CW5-04	UCS-1	9.61-9.88	60.90	137.88	29.13	401.63	1074.60	2676	0.39	2665	321.80	110.5	Not Provided	6/1	N/A
4	BH-BGC20-CW5-04	UCS-2	17.17-17.47	60.86	138.76	29.09	403.66	1071.50	2654	0.53	2641	143.90	49.5	Not Provided	5	28
5	BH-BGC20-CW5-04	UCS-3	18.36-18.80	60.96	136.82	29.19	399.33	1043.80	2614	1.41	2577	37.20	12.7	Not Provided	3*	N/A

Notes:

Test No. 2, Sample partially sheared along discontinuity

Test No. 5, Sample failed along multiple discontinuities

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

G. Patton	August 11, 2020	D. Lim	August 13, 2020
TESTED BY	DATE	CHECKED BY	DATE

GOLDER

Uniaxial Compressive Strength of Intact Rock Core Specimens (Method C)

ASTM D7012

Project No.:	19131807-18000	**Borehole:**	BH-BGC20-CW5-02
Project:	TMEP CWIR South	**Sample Number:**	UCS-1
Location:	Not Provided	**Depth (m):**	47.71-47.96
Client:	BGC Engineering Inc.	**Lab ID No:**	B20-264

Testing Results

Max Load (kN)	**264.50**
Stress σ_u (MPa)	**90.7**
Pace Rate (kN/s)	1.25
Lithology	Not Provided

Sample Measurements

Diameter	(mm)	60.92
Height	(mm)	138.33
Area	(cm²)	29.15
Volume	(cm³)	403.21
Mass	(g)	1012.40
Moisture Content (%)		1.15
Wet Density	(kg/m³)	2511
Dry Density	(kg/m³)	2482

BEFORE TEST

Failure Mode

Type:	**3/6**
α angle:	**N/A**

* Degrees measured with respect to core axis.

The impact of any pre-existing feature on the test results will be noted in the comments, if applicable.

Notes

- Water content as received
- Wet density based on as received moisture

Mode:

(1) Simple Extension
(2) Multiple Extension
(3) Multiple Fracturing
(4) Multiple Shear
(5) Single Shear
(6) Spalling
(7) Other

Comments

AFTER TEST

G. Patton	August 11, 2020	D. Lim	August 13, 2020
TESTED BY	DATE	CHECKED BY	DATE

Uniaxial Compressive Strength of Intact Rock Core Specimens (Method C)

ASTM D7012

Project No.:	19131807-18000	**Borehole:**	BH-BGC20-CW5-02
Project:	TMEP CWIR South	**Sample Number:**	UCS-2
Location:	Not Provided	**Depth (m):**	49.18-49.40
Client:	BGC Engineering Inc.	**Lab ID No:**	B20-264

Testing Results

Max Load (kN)	**112.10**
Stress σ_u (MPa)	**38.4**
Pace Rate (kN/s)	1.25
Lithology	Not Provided

Sample Measurements

Diameter	(mm)	60.95
Height	(mm)	137.99
Area	(cm²)	29.18
Volume	(cm³)	402.61
Mass	(g)	1007.50
Moisture Content (%)		1.38
Wet Density	(kg/m³)	2502
Dry Density	(kg/m³)	2468

BEFORE TEST

Failure Mode

Type:	**5***
α angle:	**28**

* Degrees measured with respect to core axis.

The impact of any pre-existing feature on the test results will be noted in the comments, if applicable.

Notes

- Water content as received
- Wet density based on as received moisture

Mode:

(1) Simple Extension
(2) Multiple Extension
(3) Multiple Fracturing
(4) Multiple Shear
(5) Single Shear
(6) Spalling
(7) Other

AFTER TEST

Comments

* Partial shear along discontinuity

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

G. Patton	August 11, 2020	D. Lim	August 13, 2020
TESTED BY	DATE	CHECKED BY	DATE

Uniaxial Compressive Strength of Intact Rock Core Specimens (Method C)

ASTM D7012

Project No.:	19131807-18000	**Borehole:**	BH-BGC20-CW5-04
Project:	TMEP CWIR South	**Sample Number:**	UCS-1
Location:	Not Provided	**Depth (m):**	9.61-9.88
Client:	BGC Engineering Inc.	**Lab ID No:**	B20-264

Testing Results

Max Load (kN)	**321.80**
Stress σ_u (MPa)	**110.5**
Pace Rate (kN/s)	1.25
Lithology	Not Provided

Sample Measurements

Diameter	(mm)	60.90
Height	(mm)	137.88
Area	(cm²)	29.13
Volume	(cm³)	401.63
Mass	(g)	1074.60
Moisture Content (%)		0.39
Wet Density	(kg/m³)	2676
Dry Density	(kg/m³)	2665

BEFORE TEST

Failure Mode

Type:	**6/1**
α angle:	**N/A**

* Degrees measured with respect to core axis.

The impact of any pre-existing feature on the test results will be noted in the comments, if applicable.

Notes

- Water content as received
- Wet density based on as received moisture

Mode:

(1) Simple Extension
(2) Multiple Extension
(3) Multiple Fracturing
(4) Multiple Shear
(5) Single Shear
(6) Spalling
(7) Other

AFTER TEST

Comments

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

G. Patton	August 11, 2020	D. Lim	August 13, 2020
TESTED BY	DATE	CHECKED BY	DATE

GOLDER

Uniaxial Compressive Strength of Intact Rock Core Specimens (Method C)

ASTM D7012

Project No.:	19131807-18000	**Borehole:**	BH-BGC20-CW5-04
Project:	TMEP CWIR South	**Sample Number:**	UCS-2
Location:	Not Provided	**Depth (m):**	17.17-17.47
Client:	BGC Engineering Inc.	**Lab ID No:**	B20-264

Testing Results

Max Load (kN)	**143.90**
Stress σ_u (MPa)	**49.5**
Pace Rate (kN/s)	1.25
Lithology	Not Provided

Sample Measurements

Diameter	(mm)	60.86
Height	(mm)	138.76
Area	(cm²)	29.09
Volume	(cm³)	403.66
Mass	(g)	1071.50
Moisture Content (%)		0.53
Wet Density	(kg/m³)	2654
Dry Density	(kg/m³)	2641

BEFORE TEST

Failure Mode

Type:	**5**
α angle:	**28**

* Degrees measured with respect to core axis.

The impact of any pre-existing feature on the test results will be noted in the comments, if applicable.

Notes

- Water content as received
- Wet density based on as received moisture

Mode:

(1) Simple Extension
(2) Multiple Extension
(3) Multiple Fracturing
(4) Multiple Shear
(5) Single Shear
(6) Spalling
(7) Other

Comments

AFTER TEST

The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

G. Patton	August 11, 2020	D. Lim	August 13, 2020
TESTED BY	DATE	CHECKED BY	DATE

GOLDER

Uniaxial Compressive Strength of Intact Rock Core Specimens (Method C)

ASTM D7012

Project No.:	19131807-18000	**Borehole:**	BH-BGC20-CW5-04
Project:	TMEP CWIR South	**Sample Number:**	UCS-3
Location:	Not Provided	**Depth (m):**	18.36-18.80
Client:	BGC Engineering Inc.	**Lab ID No:**	B20-264

Testing Results

Max Load (kN)	**37.20**
Stress σ_u (MPa)	**12.7**
Pace Rate (kN/s)	1.25
Lithology	Not Provided

Sample Measurements

Diameter	(mm)	60.96
Height	(mm)	136.82
Area	(cm²)	29.19
Volume	(cm³)	399.33
Mass	(g)	1043.80
Moisture Content (%)		1.41
Wet Density	(kg/m³)	2614
Dry Density	(kg/m³)	2577

BEFORE TEST

Failure Mode

Type:	**3***
α angle:	**N/A**

* Degrees measured with respect to core axis.

The impact of any pre-existing feature on the test results will be noted in the comments, if applicable.

Notes

- Water content as received
- Wet density based on as received moisture

Mode:

(1) Simple Extension
(2) Multiple Extension
(3) Multiple Fracturing
(4) Multiple Shear
(5) Single Shear
(6) Spalling
(7) Other

AFTER TEST

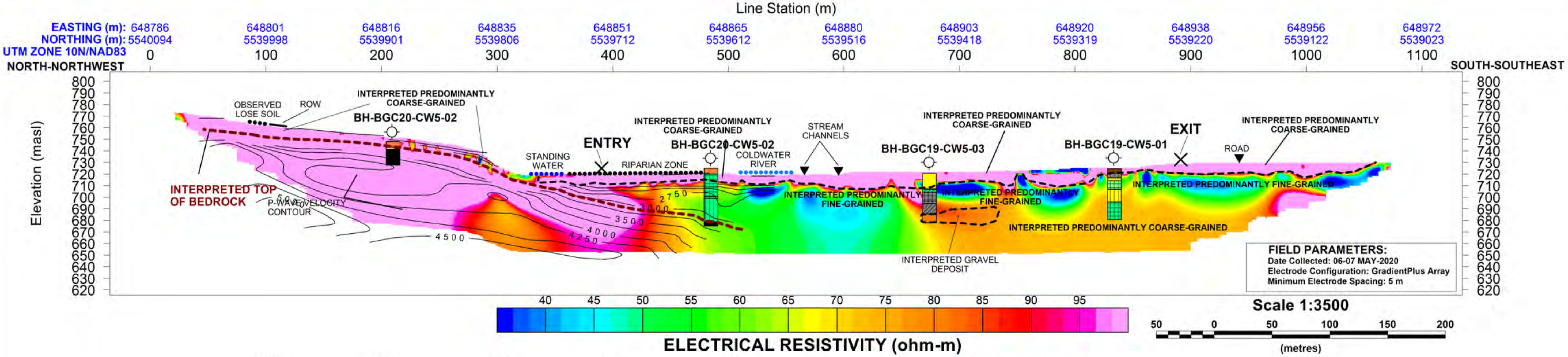
Comments

* Sample failed along multiple discontinuities

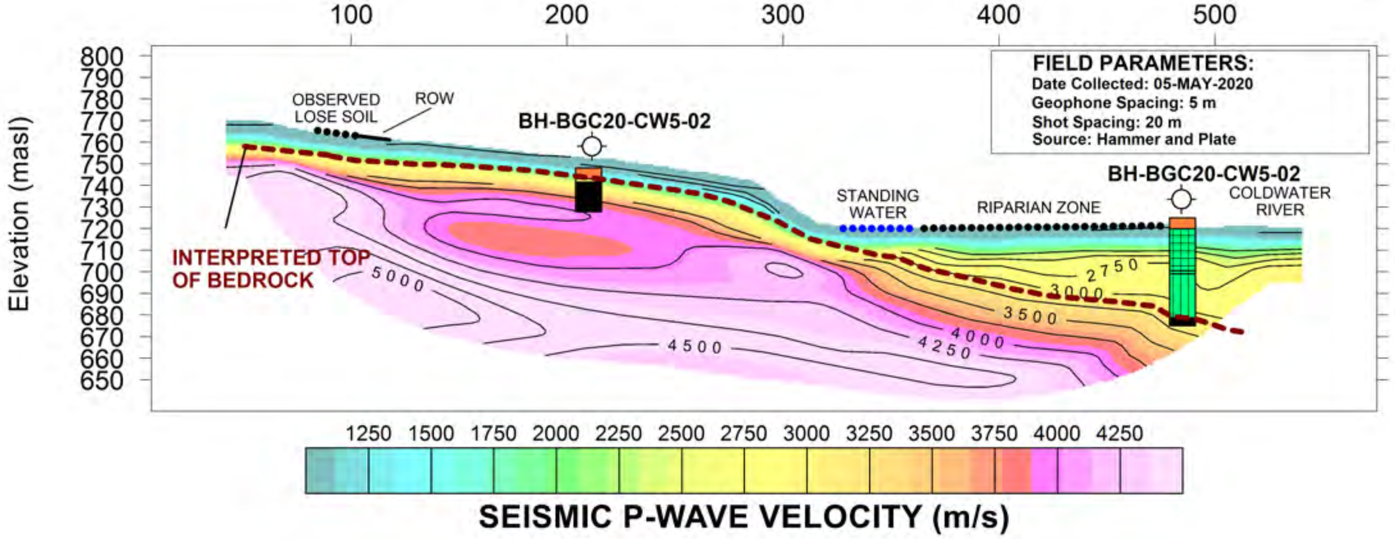
The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

G. Patton	August 11, 2020	D. Lim	August 13, 2020
TESTED BY	DATE	CHECKED BY	DATE

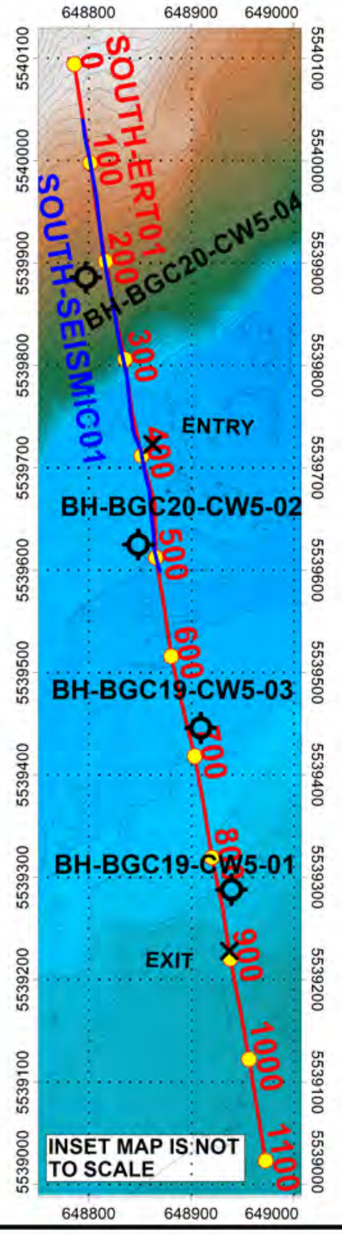
APPENDIX D
ADVISIAN GEOPHYSICAL INTERPRETATION



FIELD PARAMETERS:
Date Collected: 06-07 MAY-2020
Electrode Configuration: GradientPlus Array
Minimum Electrode Spacing: 5 m



FIELD PARAMETERS:
Date Collected: 05-MAY-2020
Geophone Spacing: 5 m
Shot Spacing: 20 m
Source: Hammer and Plate



INSET MAP IS NOT TO SCALE

LITHOLOGY LEGEND

▩	CLAY
▥	CLAY (SILTY)
▦	CLAY (SANDY)
▨	CLAY (SANDY, SOME GRAVEL)
🟩	SILT (CLAYEY)
▦	SILT (SANDY)
▨	SILT (SANDY, SOME GRAVEL)
🟨	SAND
▥	SAND (SILTY)
🟫	SAND AND GRAVEL
🟧	GRAVEL (SANDY)
⬛	BEDROCK (RHYOLITIC OR ANDESITIC VOLCANIC ROCK)

INSET MAP LEGEND

0 200	ERT LINE AND DISTANCE (METRES)
0 120	SEISMIC REFRACTION LINE DISTANCE (METRES)
～	LiDAR ELEVATION CONTOURS
⌖	BGC GEOTECHNICAL BOREHOLE

NOTES:
1. THE INTERPRETED BEDROCK SURFACE IS BASED ON CORRELATION WITH BOREHOLE LOGS, A RESISTIVITY CONTRAST OBSERVED ON THE ERT SECTION, AND GENERALLY FOLLOWS BETWEEN SEISMIC VELOCITY CONTOURS OF BETWEEN 3000 M/S AND 3500 M/S. THE BEDROCK SURFACE COULD NOT BE INTERPRETED UNDER THE SOUTH BANK OF THE CROSSING AND IS ASSUMED TO BE DEEPER THAN APPROXIMATELY 50 MBGS
2. PREDOMINANTLY FINE-GRAINED MATERIAL, ABOVE THE TOP OF BEDROCK, IS INTERPRETED TO CORRESPOND WITH RESISTIVITY VALUES LESS THAN 60 ohm-m (e.g. CLAY AND/OR SILT).
3. PREDOMINANTLY COARSE-GRAINED MATERIAL, ABOVE THE TOP OF BEDROCK, IS INTERPRETED TO CORRESPOND WITH VALUES EXCEEDING 70 ohm-m (e.g. SAND/GRAVEL).
4. CONFIRMATION OF INTERPRETATIONS BASED ON SURFACE GEOPHYSICAL TECHNIQUES REQUIRES INTRUSIVE INFORMATION (i.e. BOREHOLES). INTERPRETATIONS MAY CHANGE BASED ON ADDITIONAL BOREHOLES.

DRAFT

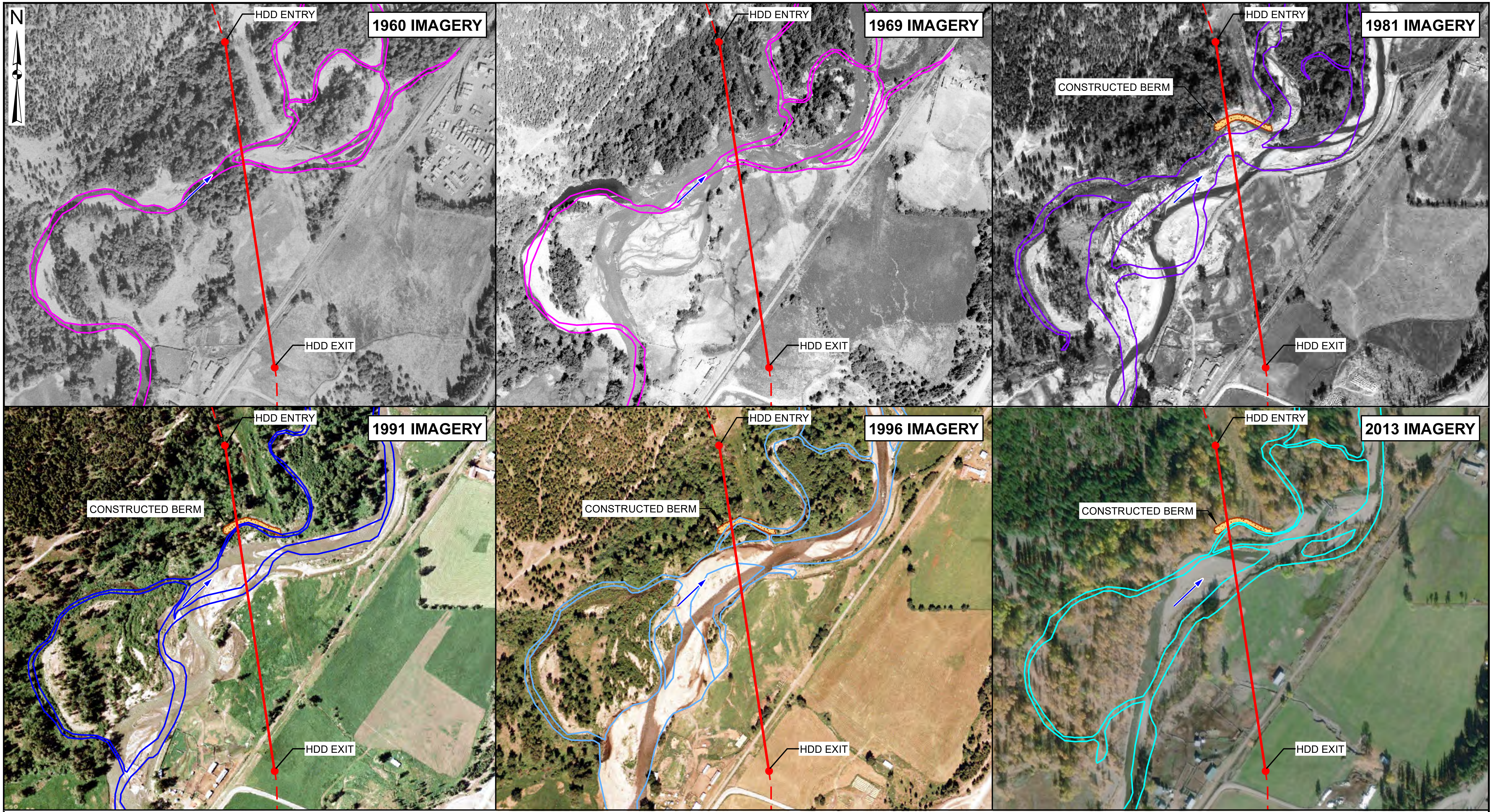
BGC ENGINEERING INC.
TRANSMOUNTAIN PIPELINE EXPANSION PROJECT (TMEP)
2020 GEOPHYSICAL INVESTIGATION AT COLDWATER HDD

SOUTH: ERT AND SEISMIC REFRACTION SECTIONS
SOUTH-ERT01 AND SOUTH-SEISMIC01 CROSS-SECTIONS

Date: 26-AUG-2020	Drawn by: LGW	Edited by: LGW	App'd by: AM
		Project No. 317011-00020-20102	
		FIG No ##	REV A

FILE: U:\CAL\GBS\317011-00020\20102 -Coldwater HDDs\10.0_Technical_Specialist\10.1_Geophysics\10.1.3_Oasis\Maps\317011-00020-GP-OAS-Coldwater_South_ERT5m_Seismic-A.map

DRAWINGS



SCALE 1:6,000

THIS DRAWING MAY HAVE BEEN REDUCED OR ENLARGED. ALL FRACTIONAL SCALE NOTATIONS INDICATED ARE BASED ON ORIGINAL FORMAT DRAWINGS.

LEGEND

PROPOSED HDD BOREPATH

COLDWATER IR REROUTE CENTRELINE

FLOW DIRECTION

CONSTRUCTED BERM

HISTORICAL CHANNEL
- 1960
- 1969
- 1981
- 1991
- 1996

NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
3. PROPOSED TRENCHLESS ALIGNMENT PROVIDED BY UPI, DATED NOVEMBER 2019. PROPOSED PIPELINE CENTRELINE VERSION FOR TMEP COLDWATER WESTERN ALTERNATIVE ROUTE DATED AUGUST 2020.
4. AIRPHOTOS FOR 1960 AND 1969 FROM THE NATIONAL AIRPHOTO LIBARARY (NAPL). AIRPHOTOS FOR 1981, 1991 AND A1996 FROM PROVINCE OF BRITISH COLUMBA. ORTHOIMAGERY FROM 2013 FROM ESRI WORLD IMAGERY, DATED JULY 2013.
5. PROJECTION IS NAD 1983 UTM ZONE 10N. VERTICAL DATUM IS CGVD28.
6. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE:	1:6,000
DATE:	SEP 2020
DRAWN:	JVC, JVT
CHECKED:	HHA
APPROVED:	MT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT:
TRANSMOUNTAIN

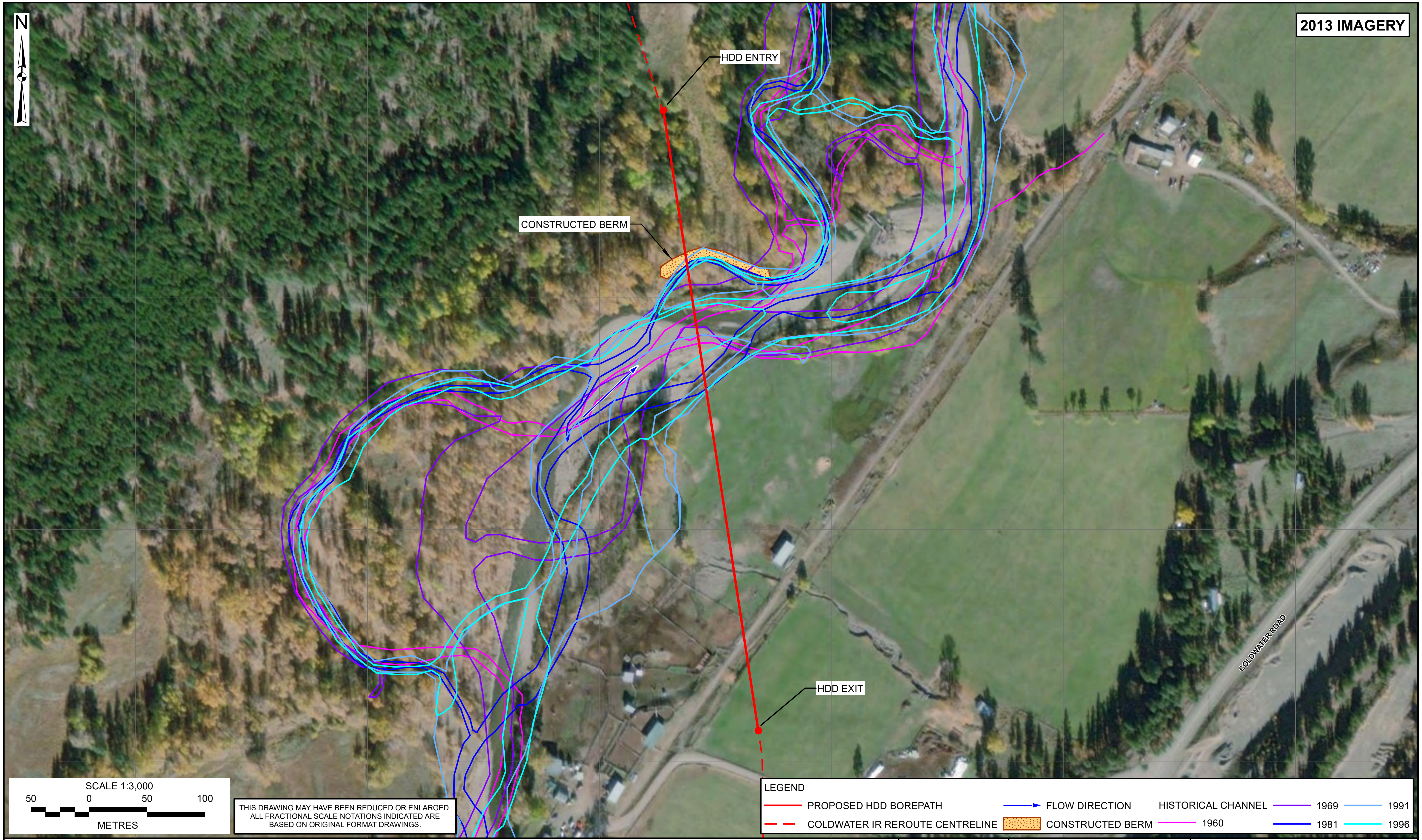
PROJECT:
GEOTECHNICAL HDD FEASIBILITY
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
BANK EROSION AND AVULSION REVIEW
(SHEET 1 OF 2)

PROJECT No.: 1321150-43

DWG No.: 01

X:\Projects\1321150\GIS\Production\Report\20200122_Geotechnical_HDD_Feasibility_Assessment_Coldwater_IR_South_Crossing\01_Bank_Erosion_Avulsion_Review.mxd



THIS DRAWING MAY HAVE BEEN REDUCED OR ENLARGED. ALL FRACTIONAL SCALE NOTATIONS INDICATED ARE BASED ON ORIGINAL FORMAT DRAWINGS.

LEGEND

PROPOSED HDD BOREPATH	FLOW DIRECTION	HISTORICAL CHANNEL	1969	1991
COLDWATER IR REROUTE CENTRELINE	CONSTRUCTED BERM	1960	1981	1996

NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
3. PROPOSED TRENCHLESS ALIGNMENT PROVIDED BY UPI, DATED NOVEMBER 2019. PROPOSED PIPELINE CENTRELINE VERSION FOR TMEP COLDWATER WESTERN ALTERNATIVE ROUTE DATED AUGUST 2020.
4. ORTHOIMAGERY FROM ESRI WORLD IMAGERY, DATED JULY 2013.
5. PROJECTION IS NAD 1983 UTM ZONE 10N. VERTICAL DATUM IS CGVD28.
6. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE: 1:3,000
DATE: SEP 2020
DRAWN: JVC, JVT
CHECKED: HHA
APPROVED: MT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

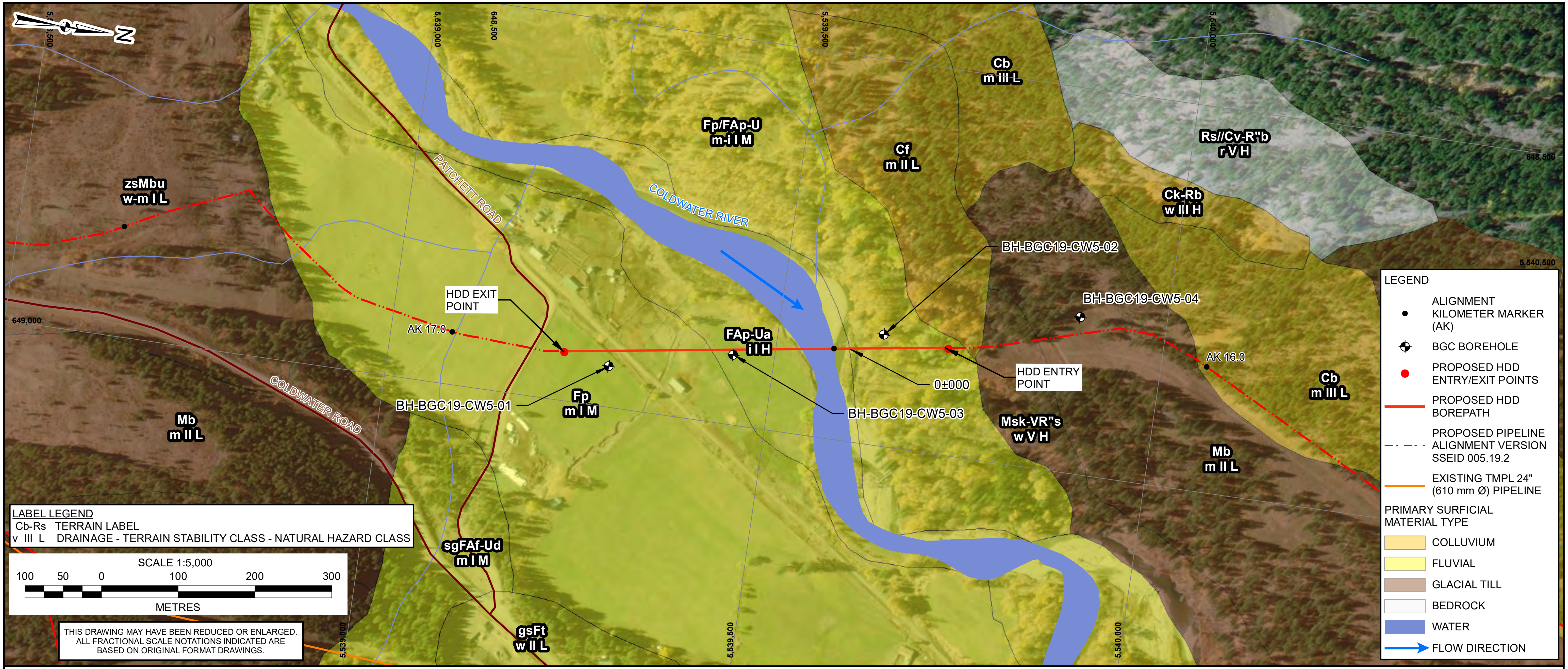
CLIENT: TRANSMOUNTAIN

PROJECT: GEOTECHNICAL HDD FEASIBILITY
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE: BANK EROSION AND AVULSION REVIEW
(SHEET 2 OF 2)

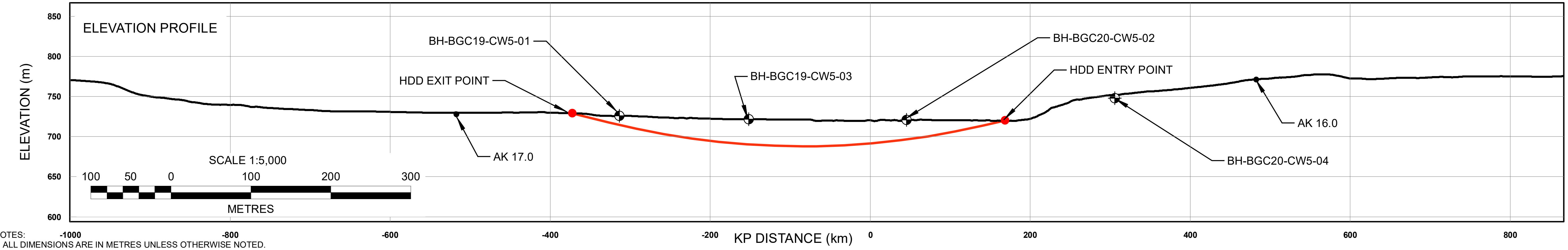
PROJECT No.: 1321150-43
DWG No.: 02

X:\Projects\1321\150\GIS\Production\Report\20200122_Geotechnical_HDD_Feasibility_Assessment_Coldwater_IR_South_Crossing\02_Bank_Erosion_Avulsion_Review.mxd



LABEL LEGEND
Cb-Rs TERRAIN LABEL
v III L DRAINAGE - TERRAIN STABILITY CLASS - NATURAL HAZARD CLASS

THIS DRAWING MAY HAVE BEEN REDUCED OR ENLARGED. ALL FRACTIONAL SCALE NOTATIONS INDICATED ARE BASED ON ORIGINAL FORMAT DRAWINGS.



NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
3. PROPOSED PIPELINE ALIGNMENT FOR COLDWATER IR WESTERN ALTERNATIVE ROUTE PROVIDED BY UPI AND DATED AUGUST 2020.
4. WATERBODY AND STREAM DATA FROM NRCAN CANVEC.
5. ROAD DATA PROVIDED BY OPENSTREETMAP, AVAILABLE AT OPENSTREETMAP.ORG.
5. IMAGERY PROVIDED BY ESRI WORLD IMAGERY, DATED OCTOBER 16, 2018.
6. PROPOSED HDD PROFILE PROVIDED BY UPI LTD. ON NOVEMBER 2019.
7. FOR A FULL EXPLANATION OF THE TERRAIN MAPPING TERMS AND SYMBOLS SEE THE COMPLETE LEGEND IN DRAWING 03B. TERRAIN POLYGONS BASED ON TERRAIN MAPPING COMPLETED UP TO AUGUST 2020 BY BGC.
8. THIS MAP IS A SNAPSHOT IN TIME. CHANGES IN LAND USE (E.G. DEVELOPMENT, RIVER MIGRATION) MAY WARRANT RE-DRAWING OF CERTAIN AREAS.
9. PROJECTION IS NAD 1983 ZONE 10. VERTICAL DATUM IS CGVD28.
10. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE:	1:5,000
DATE:	SEP 2020
DRAWN:	JVT, STT
CHECKED:	HHA
APPROVED:	MT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

CLIENT:
TRANSMOUNTAIN

PROJECT:
GEOTECHNICAL HDD FEASIBILITY
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
TERRAIN MAP

PROJECT No.: 1321-150
DWG No.: 03A

X:\Projects\1321\150\GIS\Production\Report\20200821_Geotechnical_HDD_Feasibility_Assessment_Coldwater_IR_Western_Alternative_Route_GG_Option_South_Crossing\03A_Terrain_Map.mxd

Terrain Mapping Legend

Simple Terrain Symbols: Used when one surficial material is present within a polygon

Example: Cb – Rb

Surficial Material
Surface expression
Geomorphological process sub-type
Geomorphological process (up to 3 may be assigned)

Composite Terrain Symbols: Used when 2 or 3 terrain types are present within a polygon

Cv.Mv	indicates that 'C' and 'M' are roughly equal in extent
Cv/Mv	indicates that 'C' is greater in extent than 'M' (about 60:40)
Cv//Mv	indicates that 'C' is much greater in extent than 'M' (about 80:20)

Stratigraphic Terrain Symbols

Cv|Mj	indicates that 'Cv' overlies 'Mj' Note: [ ] is also used instead of a vertical line on some maps
/Cv|Mj	indicates that 'Cv' partially overlies 'Mj'

Surficial Material Types

A	Anthropogenic	I	Ice	R	Bedrock
C	Colluvium	L	Lacustrine	WG	Glaciomarine
D	Weathered bedrock	LG	Glaciolacustrine	U	Till, Glaciolacustrine, Glaciofluvial (interbedded)
E	Eolian	M	Glacial Till		
F	Fluvial	N	Not mapped (usually a lake or large river)		
FG	Glaciofluvial	O	Organic		

Surface Expressions

a	Moderate Slope (15-26°)	p	Plain (0-3°)
b	Blanket (>2 m thick deposit)	r	Ridge
c	Cone (>15°)	s	Steep Slope (>35°)
f	Fan (<15°)	t	Terrace
h	Hummocky	u	Undulating
j	Gentle Slope (4-14°)	v	Veneer (0-2 m thick deposit)
k	Moderately Steep Slope (27-35°)	w	Variable Thickness Deposit)
m	Rolling	x	very thin veneer (0-.5m thick deposit)

Activity Level

FAp	'A' Indicates active floodplain (subject to channel changes)
CIf	'I' Indicates inactive fan

Geomorphologic Processes

A	Snow Avalanches	M	Meandering Channel
B	Braided Channel	N	Nivation
E	Melt water channels	P	Piping
F	Slow landslide (runout zone)	R	Rapid landslide (runout zone)
F"	Slow landslide (initiation zone)	R"	Rapid landslide (initiation zone)
G	Anthropogenic ground disturbance	S	Solifluction
H	Kettled	U	Flooding
I	Irregular Channel	V	Gully erosion
J	Anastamosing Channel	W	Washing
K	Karst	X	Permafrost
L	Seepage	Z	Periglacial Processes

Geomorphological Process Subtypes

a	channel avulsion	g	Rock creep	s	Debris avalanches
b	Rockfall	k	tension cracks/sacking	u	Surficial material slump
c	soil creep	m	Bedrock slump	Ud	debris floods
d	Debris flows	r	Rock slides	x	slump/earth flow combined
e	Earthflow				

Textural Terms and Symbols

a	blocks	g	gravel	s	sand
b	boulders	h	humic organics	u	mesic organics
c	clay	k	cobbles	x	angular fragments
d	mixed fragments	m	mud	z	silt
e	fibric organic	p	pebbles		

Terrain Stability Class

I	No significant stability problems exist.
II	There is a very low likelihood of landslides following right of way clearing, pipeline and road construction. Minor instability is expected along cut slopes, especially for 1 or 2 years following construction
III	There is a low likelihood of landslide initiation following right of way clearing, pipeline and road construction. Minor instability is expected along cut slopes, especially for 1 or 2 years following construction.
IV	Expected to contain areas with a moderate likelihood of landslide initiation following right of way clearing, pipeline and road construction. Wet season construction will significantly increase the potential for construction-related landslides.
V	Expected to contain areas with a high likelihood of landslide initiation following right of way clearing, pipeline and road construction. Wet and or winter season construction will significantly increase the potential for construction-related landslides.

Natural Hazard Classes

L	No existing hazard, or hazard is dormant. i.e. hazard has not been active in the last 100 to 1,000 years or it has developed under different climatic conditions.
M	Hazard is inactive. Vegetated tracks can be observed in airphotos. Smaller more frequent events, such as rock fall, may affect a small area of the polygon. No evidence that the hazard has been active within 20 years but trigger is present. Hazard is unlikely to occur within the life of the project.
H	Hazard is currently active or shows evidence of activity in the last 20 years. Hazard likely to occur within the life of the project.

Soil Drainage Classes

r	Rapidly drained	Water is removed from the soil rapidly in relation to supply.
w	Well-drained	Water is removed from the soil readily but not rapidly.
m	Moderately well-drained	Water is removed from the soil somewhat slowly in relation to supply.
i	Imperfectly drained	Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season.
p	Poorly drained	Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen.
v	Very poorly drained	Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen.

Examples

Rs//Cv – VR"bd w V H	Steep bedrock slope with <20% cover of a colluvial veneer; gullied with initiation zones for rockfall and debris flows. Well drained. Expected to contain areas with a high likelihood of landslide initiation following road construction. Debris flows and rock fall are likely to occur within the life of the project.
sgFAp -U i I M	Active floodplain composed of sand and gravel potentially subject to flooding. Imperfectly drained. No significant stability problems exist. Inactive flood hazard is unlikely to occur during the lifetime of the project
zcLGks-VR"s m V M	Moderately steep to steep glaciolacustrine slope composed of silt and clay, with gullies, moderately well drained. High likelihood of debris avalanches following major landform changes. Small natural debris slides are possible within 20 years.

Label Legend

Cbs-Rs	TERRAIN LABEL
w III M	DRAINAGE, TERRAIN STABILITY CLASS AND NATURAL HAZARD CLASS

SACKUNG

LANDSLIDE SCARP

LANDSLIDE PATH

NOTES:
1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
2. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE: NTS
DATE: SEP 2020
DRAWN: JVT, STT
CHECKED: HHA
APPROVED: MT

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

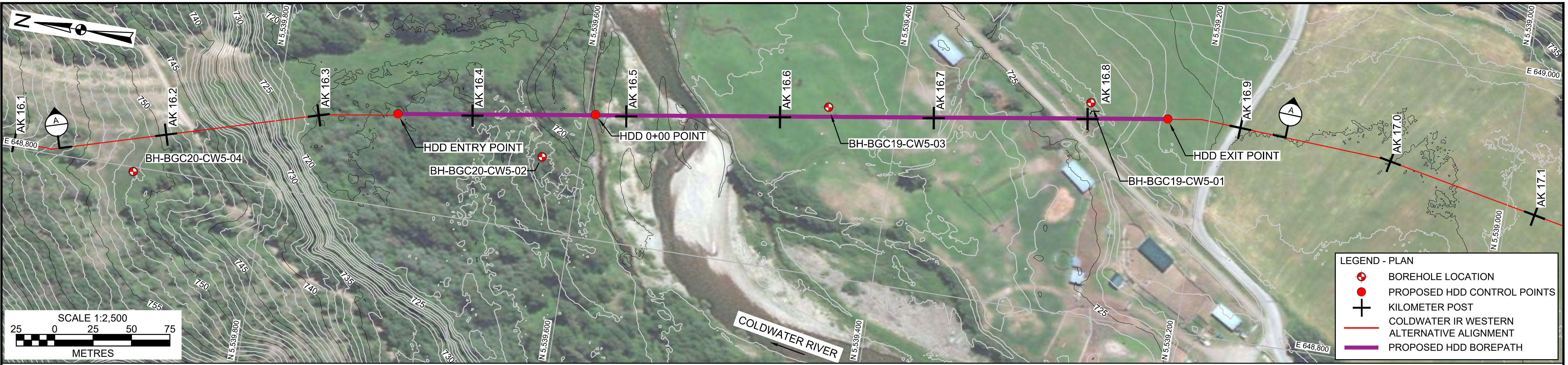
CLIENT:
TRANSMOUNTAIN

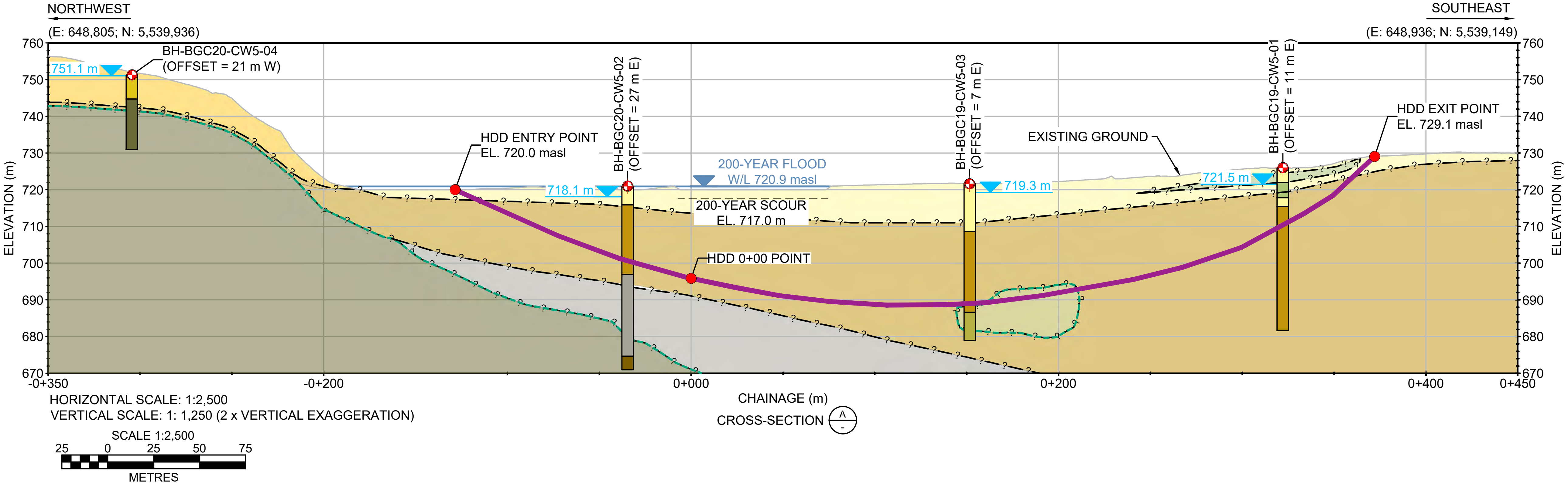
PROJECT:
GEOTECHNICAL HDD FEASIBILITY
COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
TERRAIN MAP LEGEND

PROJECT No.: 1321-150
DWG No.: 03B

X:\Projects\1321\150\GIS\Production\Report\20200821_Geotechnical_HDD_Feasibility_Assessment_Coldwater_IR_Western_Alternative_Route_GG_Option_South_Crossing\03B_Terrain_Legend.mxd





NOTES:
1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
3. BASE TOPOGRAPHIC DATA BASED ON LIDAR PROVIDED BY AIRBORNE IMAGERY, DATED JULY 2019. CONTOUR INTERVAL IS 1 m.
4. PROPOSED PIPELINE ALIGNMENT FOR COLDWATER IR WESTERN ALTERNATIVE ROUTE PROVIDED BY UPI, DATED AUGUST 2020.
5. PROPOSED HDD ALIGNMENT AND BOREHOLE PATH PROVIDED BY UPI, AND DATED NOVEMBER 2019.
6. COORDINATE SYSTEM IS NAD 83 ZONE 10N. VERTICAL DATUM IS CGVD 28 AND ELEVATIONS ARE IN METRES.
7. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

GROUND WATER OBSERVATIONS

BOREHOLE	BOREHOLE COLLAR ELEVATION (masl)	INFERRED WATER LEVEL (masl)	WATER LEVEL ELEVATION (masl)	COMMENTS
BH-BGC19-CW5-01	726.0	4.5	721.5	MEASURED AT THE START OF SHIFT ON NOVEMBER 27, 2019 WHEN BOREHOLE DEPTH WAS 32.2 m
BH-BGC20-CW5-02	721.0	2.9	718.1	MEASURED AT THE START OF THE SHIFT ON JULY 23, 2020 WHEN BOREHOLE DEPTH WAS 50.0 m
BH-BGC19-CW5-03	721.6	2.3	719.3	MEASURED AT THE START OF THE SHIFT ON NOVEMBER 29, 2019 ARTESIAN CONDITIONS OBSERVED AT APPROXIMATELY 37 m DEPTH
BH-BGC20-CW5-04	751.3	0.2	751.1	MEASURED AT THE END OF SHIFT ON JULY 24, 2020 WHEN BOREHOLE DEPTH WAS 21.3 m

BOREHOLE INTERPRETED GEOLOGY

🟨	GRAVEL (COLLUVIUM)
🟨	SAND AND GRAVEL (FLUVIAL)
🟩	SILT AND CLAY (FLUVIAL OVERBANK)
🟫	SILT AND SAND (TILL)
🟩	SAND AND GRAVEL (GLACIOFLUVIAL)
⬜	SILT (GLACIOLACUSTRINE)
🟫	INTRUSIVE VOLCANIC BEDROCK (SPENCE'S BRIDGE GROUP)

LEGEND - SECTION

⊕	BOREHOLE LOCATION
●	PROPOSED HDD CONTROL POINTS
━	PROPOSED HDD BOREPATH
- - -	INFERRED CONTACT FROM GEOPHYSICAL SURVEY
–?–	UNCERTAIN GEOLOGY CONTACT
▼	200 YEAR FLOOD LEVEL
▼	OBSERVED BOREHOLE WATER LEVEL

SCALE:	AS SHOWN
DATE:	SEP 2020
DRAWN:	AL
REVIEW:	HHA
APPROVED:	MT

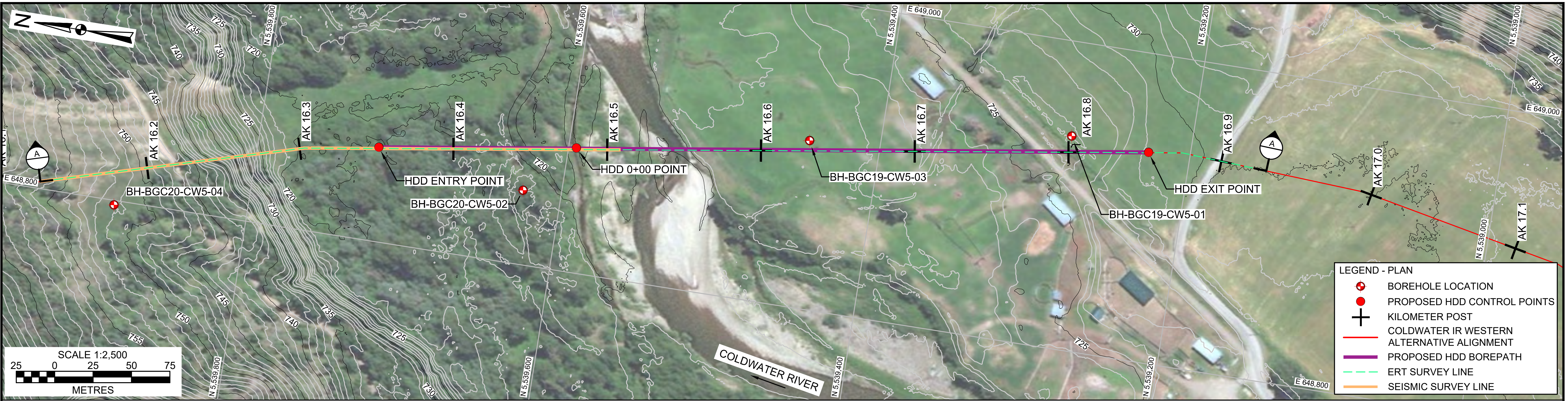
CLIENT:
TRANSMOUNTAIN
BGC

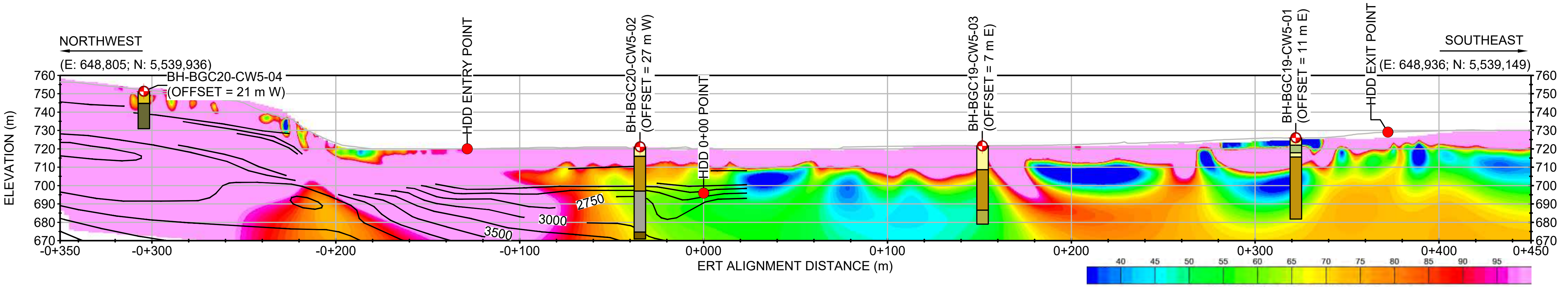
PROJECT:
GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

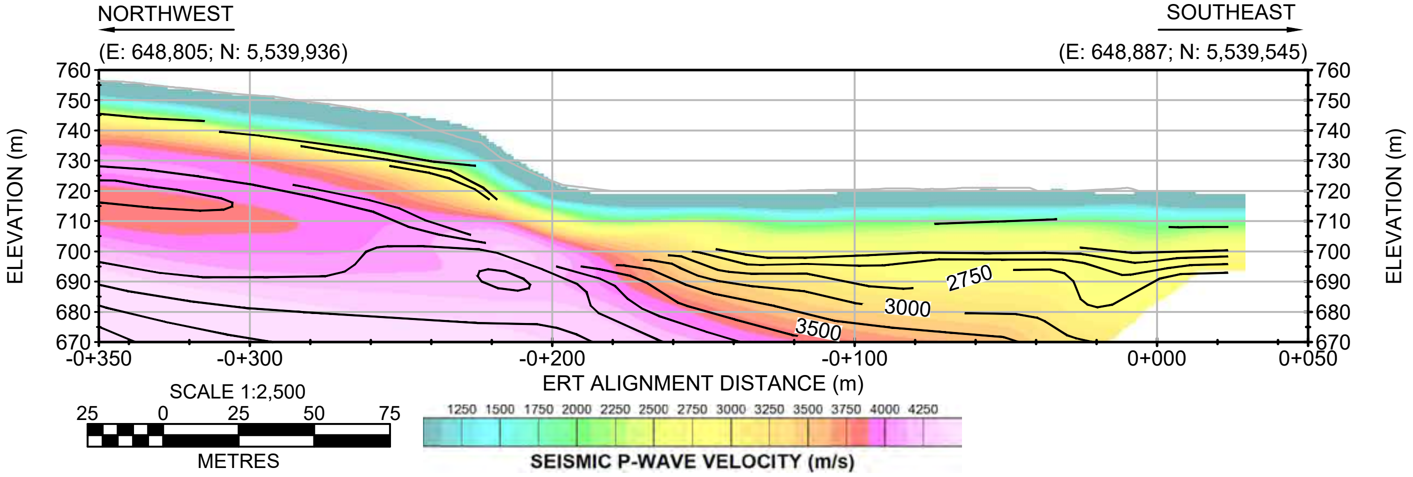
TITLE:
INTERPRETED GEOLOGICAL SECTION

PROJECT No.: 1321150
DWG No.: 04

C:_Vault\Projects\1321-TMEP-CAD\Production\Report-Memo\20191223_GEOTECHNICAL_HDD_FEASIBILTY_ASSESSMENT_COLDWATER_RIVER\01.dwg Layout: 04 Plot Date Sep 1 20 Time: 3:25 PM Last Saved By: ALU







BOREHOLE INTERPRETED GEOLOGY

🟧	GRAVEL (COLLUVIUM)
🟨	SAND AND GRAVEL (FLUVIAL)
🟫	SILT AND SAND (TILL)
🟩	SILT (FLUVIAL OVERBANK)
🟩	SAND AND GRAVEL (GLACIOFLUVIAL)
⬜	SILT (GLACIOLACUSTRINE)
⬛	INTRUSIVE VOLCANIC BEDROCK (SPENCE'S BRIDGE GROUP)

LEGEND - SECTION

⊕	BOREHOLE LOCATION
●	PROPOSED HDD CONTROL POINTS
—	P-WAVE VELOCITY CONTOURS

NOTES:

1. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
3. BASE TOPOGRAPHIC DATA BASED ON LIDAR PROVIDED BY AIRBORNE IMAGERY, DATED JULY 2019. CONTOUR INTERVAL IS 1 m.
4. PROPOSED PIPELINE ALIGNMENT FOR COLDWATER IR WESTERN ALTERNATIVE ROUTE PROVIDED BY UPI, DATED AUGUST 2020.
5. PROPOSED HDD ALIGNMENT AND BOREHOLE PATH PROVIDED BY UPI, AND DATED NOVEMBER 2019.
6. COORDINATE SYSTEM IS NAD 83 ZONE 10N. VERTICAL DATUM IS CGVD 28 AND ELEVATIONS ARE IN METRES.
7. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE:	1:2,500
DATE:	SEP 2020
DRAWN:	AL
REVIEW:	HHA
APPROVED:	MT

CLIENT: TRANSMOUNTAIN

PROJECT:
GEOTECHNICAL HDD FEASIBILITY COLDWATER
IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
ERT AND SEISIMIC INTERPRETED
GEOLOGICAL SECTIONS

PROJECT No.: 1321150

DWG No.: 05

C:\ Vault\Projects\1321-TMEP-CAD\Production\Report-Memo\20191223_GEOTECHNICAL_HDD_FEASIBILITY_ASSESSMENT_COLDWATER_RIVER\01.dwg Layout: 05 Plot Date Sep 1 20 Time: 10:23 AM Last Saved By: ALU

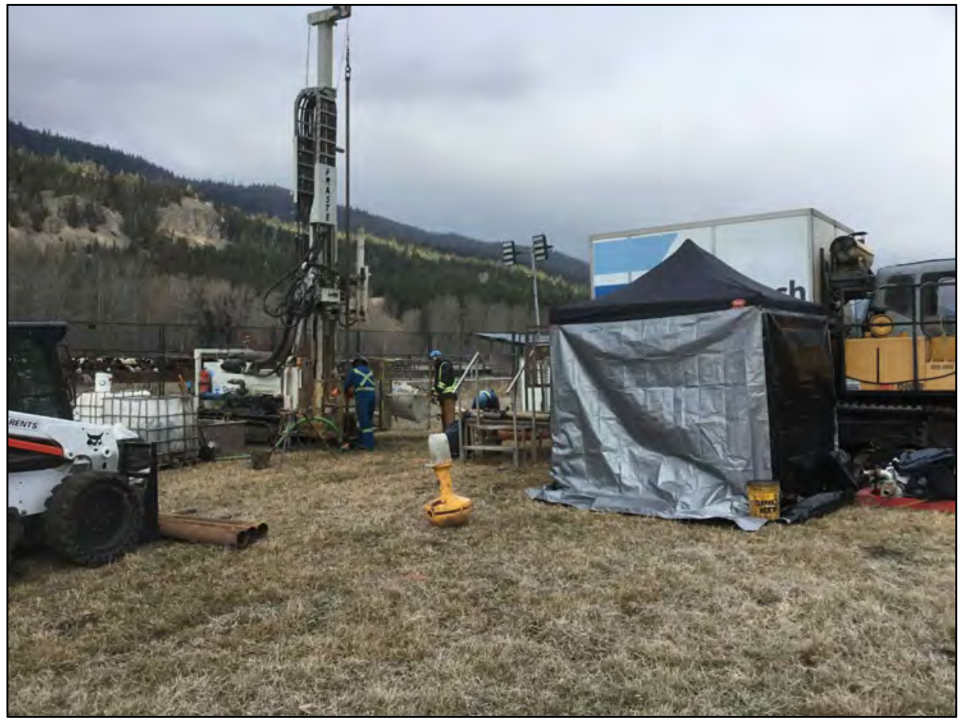


PHOTO 1: DRILL SET UP AT BG-BGC19-CW5-01. A SIMILAR SETUP WAS USED FOR BH-BGC19-CW5-03.

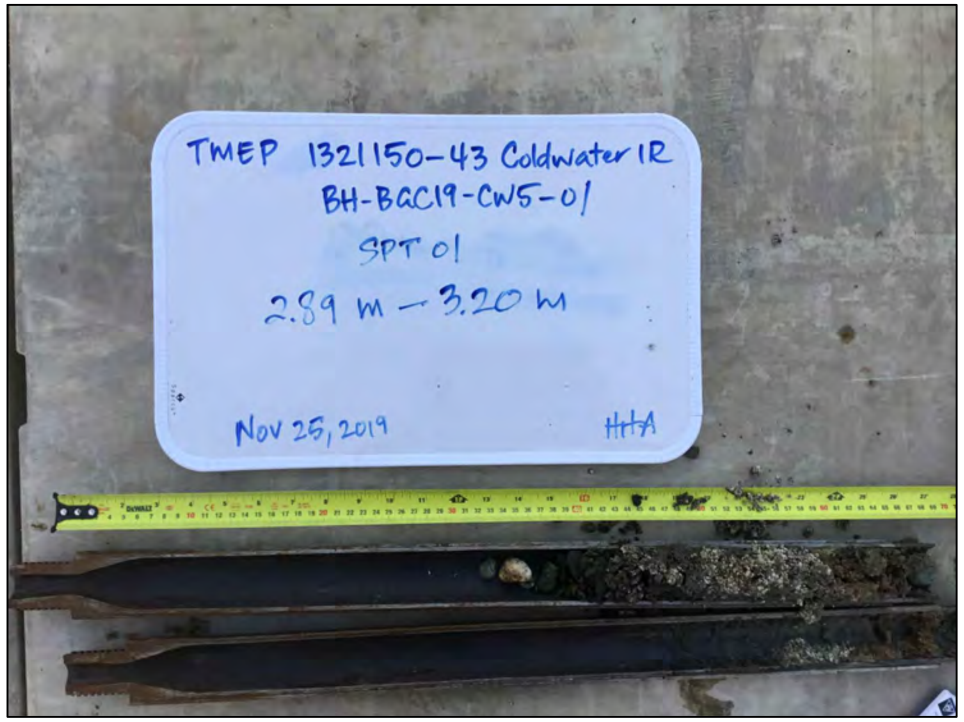


PHOTO 2: SAND AND GRAVEL FLUVIAL DEPOSITS OBSERVED AT SURFACE IN BH-BGC19-CW5-01, -03 AND BH-BGC20-CW5-02.

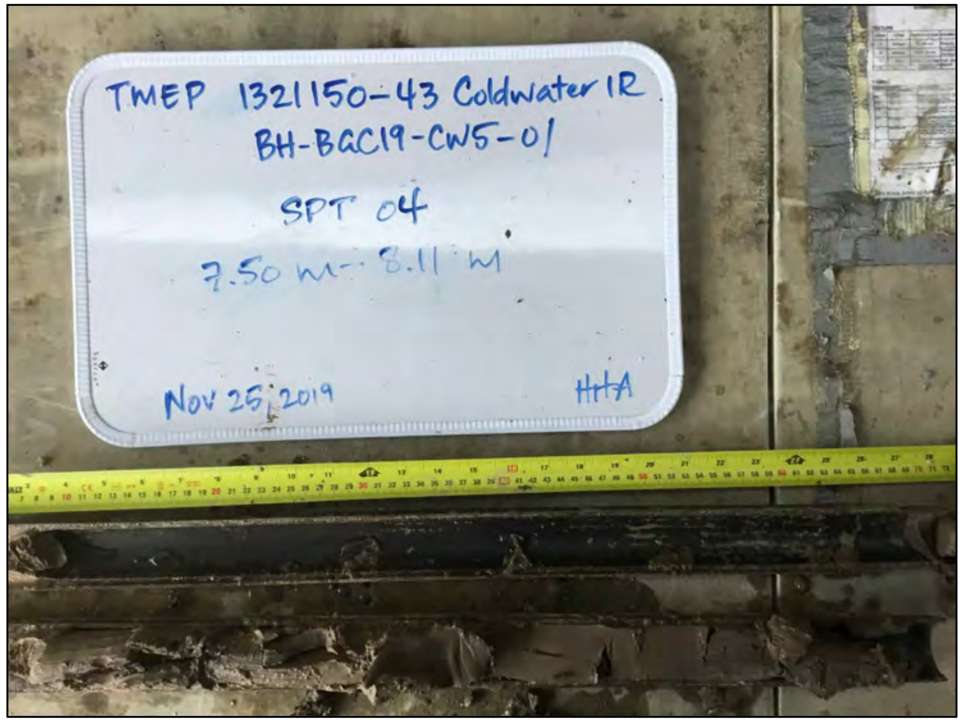


PHOTO 3: BH-BGC19-CW5-01 SPT 04 FROM 7.50 m TO 8.1 m IN FLUVIAL OVERBANK CLAY DEPOSITS.

PHOTO 4: BH-BGC19-CW5-01 SPT 15 SAMPLE FROM 30.28 m TO 30.88 m. TYPICAL SAMPLE OF TILL FOUND IN BH-BGC20-CW19-CW5-01, BH-BGC19-CW5-03 AND BH-BGC20-CW5-02.

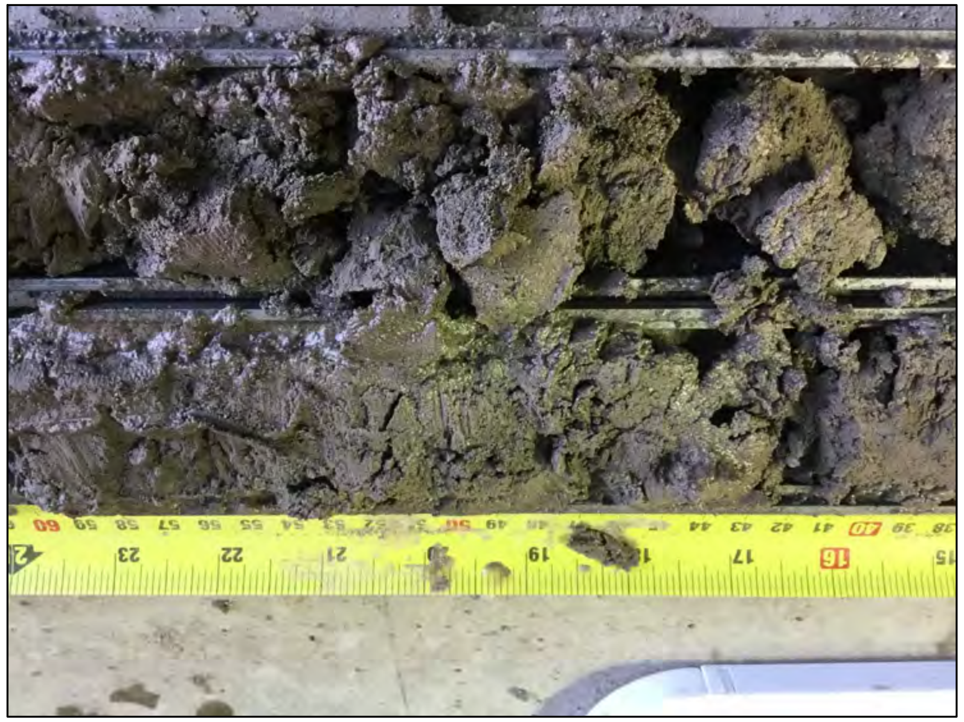


PHOTO 5: BH-BGC19-CW5-03 SPT 08 FROM 13.41 m TO 13.72 m IN TILL SAMPLE.

PHOTO 6: BH-BGC19-CW5-03 SPT 18 FROM 39.33 m TO 39.59 m IN GLACIOFLUVIAL GRAVEL.

NOTES:

1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
2. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE:	N.T.S.
DATE:	SEP 2020
DRAWN:	AL
REVIEW:	HHA
APPROVED:	MT

CLIENT:
TRANSMOUNTAIN
BGC

PROJECT:
GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5

TITLE:
FIELD PHOTOS 1

PROJECT No.: 1321150
DWG No.: 6A

C:_Vault\Projects\1321-TMEP-CAD\Production\Report-Memo\20191223_GEOTECHNICAL_HDD_FEASIBILTY_ASSESSMENT_COLDWATER_RIVER\03_FIELD_PHOTOS_1.dwg Layout: 6A Plot Date Sep 1 20 Time: 9:56 AM Last Saved By: ALU

PHOTO 7: RHYTHMIC LAMINATIONS ENCOUNTERED WITHIN GLACIAL SEDIMENTS FROM 24 m TO 33 m IN BH-BGC20-CW5-02.

PHOTO 8: RHYOLITE ENCOUNTERED BELOW 46.30 m IN BH-BGC20-CW5-02.

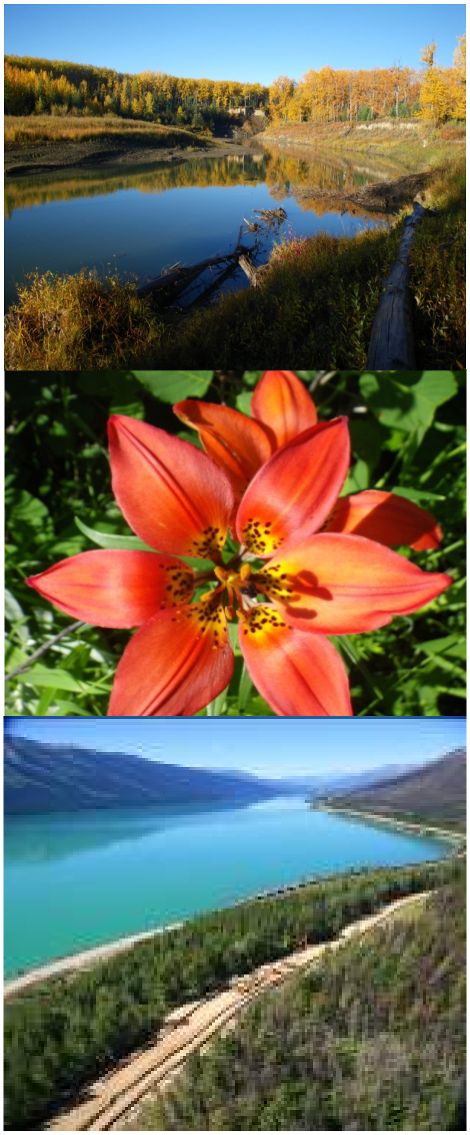
PHOTO 9: ANDESITIC ROCK ENCOUNTERED BELOW 6.56 m IN BH-BGC20-CW5-04.

NOTES:
1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH BGC'S REPORT TITLED "GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5", AND DATED SEPTEMBER 2020.
2. UNLESS BGC AGREES OTHERWISE IN WRITING, THIS DRAWING SHALL NOT BE MODIFIED OR USED FOR ANY PURPOSE OTHER THAN THE PURPOSE FOR WHICH BGC GENERATED IT. BGC SHALL HAVE NO LIABILITY FOR ANY DAMAGES OR LOSS ARISING IN ANY WAY FROM ANY USE OR MODIFICATION OF THIS DOCUMENT NOT AUTHORIZED BY BGC. ANY USE OF OR RELIANCE UPON THIS DOCUMENT OR ITS CONTENT BY THIRD PARTIES SHALL BE AT SUCH THIRD PARTIES' SOLE RISK.

SCALE: N.T.S.	CLIENT: TRANSMOUNTAIN	PROJECT: GEOTECHNICAL HDD FEASIBILITY COLDWATER IR SOUTH AT SSEID 005.19.2 AK 16.5	
DATE: SEP 2020		TITLE: FIELD PHOTOS 2	
DRAWN: AL	BGC		
REVIEW: HHA		PROJECT No.: 1321150	DWG No.: 6B
APPROVED: MT			

C:_Vault\Projects\1321-TMEP-CAD\Production\Report-Memo\20191223_GEOTECHNICAL_HDD_FEASIBILTY_ASSESSMENT_COLDWATER_RIVER\03_FIELD_PHOTOS_1.dwg Layout: 6B Plot Date Sep 1 20 Time: 9:57 AM Last Saved By: ALU

Appendix B Environmental and Socio-economic Assessment of the Coldwater West Alternative



ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT FOR THE COLDWATER WEST ALTERNATIVE REROUTE FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

October 2020
FINAL
01-13283-S5A-M002-EV-RPT-0006

Prepared for:

TRANSMOUNTAIN

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

Jacobs

Jacobs Consultancy Canada Inc.
205 Quarry Park Blvd SE
Calgary, Alberta T2C 3E7
Ph. 403-407-8700

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
°	degree(s)
AAC	annual allowable cut
AIA	Archaeological Impact Assessment
AK	Alternative Kilometre Post
ALR	Agricultural Land Reserve
ARD	acid rock drainage
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC MFLNRORD	British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BGC	biogeoclimatic
CO_{2e}	carbon dioxide equivalent
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
Coldwater IR	Coldwater Indian Reserve No. 1
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPCN	Certificate of Public Convenience and Necessity
DPI	Direct Pipe® Installation
EAS	Environmental Alignment Sheet
ECCC	Environment and Climate Change Canada
EPP	Environmental Protection Plan
ESA	Environmental and Socio-economic Assessment
FCA	Federal Court of Appeal
GBA+	gender-based analysis plus
GHG	greenhouse gas
ha	hectare(s)
HADD	harmful alteration, disruption or destruction
HDD	horizontal directional drill
HORU	Human Occupancy and Resource Use
km	kilometre(s)
KP	Kilometre Post
LSA	Local Study Area
m	metre(s)
m^3	cubic metre(s)
mm	millimetre(s)
NEB	National Energy Board
NNTC	Nlaka'pamux Nation Tribal Council
OCP	Official Community Plan
OGMA	Old Growth Management Area
Reroute Corridor	an approximate 300 m wide band generally centred on the pipeline centreline (*i.e.*, 150 m on both sides).
Reroute Footprint	a preliminary construction footprint that includes the right-of-way, temporary workspaces, access roads, and extra temporary workspace required for construction.
RSMT	Resource-Specific Mitigation Table
SARA	*Species at Risk Act*
STC	Scw'exmx Tribal Council
TDR	Technical Data Report
the Application	Facilities Application under Section 52 of the *National Energy Board Act*
the Approved Route	Project corridor previously approved by Canada Energy Regulator, which passed to the east of Coldwater Indian Reserve No. 1
the Project or TMEP	Trans Mountain Expansion Project
the Reroute or West Alternative Route	approximately 18.4 km Reroute of the Project to the west of the Approved Route and the Coldwater Indian Reserve No. 1
TLRU	Traditional Land and Resource Use
TLU	Traditional Land Use
TMPL	Trans Mountain Pipeline system (existing)
TNIPMC	Thompson-Nicola Invasive Plant Management Committee
Trans Mountain	Trans Mountain Pipeline ULC
TSA	Timber Supply Area
WHA	Wildlife Habitat Area
UWR	Ungulate Winter Range
ZOI	zone of influence

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) submitted a Facilities Application under Section 52 of the *National Energy Board Act* (the Application) to the Canada Energy Regulator (CER) (formerly the National Energy Board [NEB]) in December 2013 for the Trans Mountain Expansion Project (the Project or TMEP). A Certificate of Public Convenience and Necessity (CPCN) was issued by the CER on June 21, 2019.

Trans Mountain is proposing an approximately 18.4 km Reroute (the Reroute or West Alternative Route) from the current Project routing in proximity to the Coldwater Indian Reserve No. 1 (Coldwater IR) in British Columbia (BC). A western route option that avoided the Coldwater IR was considered during early Project planning but was ultimately not selected as a preferred route (refer to Section 4.2 of the original Environmental and Socio-economic Assessment [ESA] [Filing ID A3S1L4]).

Coldwater Indian Band has suggested that a refined western route option be considered, and Trans Mountain committed to conducting a Feasibility Study in response to concerns raised by Coldwater Indian Band regarding the route previously approved by the CER (the Approved Route). The approximately 18.4 km long Reroute deviates from the Approved Route at KP 931.4, re-joining at KP 946.88 (Figure 1). The Reroute was not included in the approved pipeline corridor; therefore, an Application for Variance under Section 190 of the *Canadian Energy Regulator Act* (*CER Act)* is required to vary the CPCN to reflect changes to the previously approved Application.

The purpose of this report is to fulfil the environmental and socio-economic filing requirements outlined in the CER Filing Manual Guide O and Guide A.2 (CER 2020) for the Reroute. This document includes:

- a summary of consultation and engagement efforts regarding the Reroute (Section 2.0)
- a review of the environmental and socio-economic information collected for the Reroute (Section 3.0) and additional setting information, where applicable (subsection 3.1)
- a review of the Reroute in the context of the potential effects, mitigation measures and residual effects identified in the original ESA (subsection 3.2)
- identification of any mitigation measures that are beyond those identified in the OH-001-2014 proceeding, and confirmation of inclusion of updated mitigation in the Project Environmental Plans (subsection 3.2)
- review of the significance conclusions reached in the original ESA (subsection 3.2)
- determination of any additional surveys or studies needed (subsection 3.2)

Environmental Resource Maps are provided in Appendix G clearly depicting the Reroute and summarizing the pertinent environmental information gathered during field surveys completed to date and desktop research. If the Variance Application is approved, Environmental Alignment Sheets (EAS) and Resource-Specific Mitigation Tables (RSMTs) depicting environmental features and associated key mitigation measures will be provided to the CER prior to construction.

1.1 Background

In December 2013, Trans Mountain submitted the original Application for the Project. On November 29, 2016, the Government of Canada concluded the Project was in the public interest of Canada. A CPCN and other authorizations allowing the Project to proceed, subject to 157 Conditions, were issued and became effective on December 1, 2016. Following the Federal Court of Appeal (FCA) Decision on August 30, 2018, the CPCN authorizing the construction of TMEP was declared null and void. The Project was put into a safe shut-down, pending further review by the Federal government. The CER conducted a Reconsideration Process (MH-052-2018) to address faults found by the FCA in its disposition of marine traffic-related matters. The Federal government was also directed by the FCA to conduct additional consultation with affected Indigenous groups. For Coldwater Indian Band, the re-initiated consultation process focused on the aquifer under their reserve and routing considerations, including the Reroute.

As of August 31, 2018, the existing Trans Mountain Pipeline system (TMPL) and TMEP are now part of Trans Mountain Corporation, a wholly owned subsidiary of the Canada Development Investment Corporation that is accountable to the Parliament of Canada. Trans Mountain is a general partner of Trans Mountain Pipeline L.P., which is operated by Trans Mountain Canada Inc. Trans Mountain is the holder of the CER certificates for the operation of TMPL (OC-02, OC-049) and for the construction and operation of the TMEP (OC-065).

On June 18, 2018, the Governor General in Council, on the recommendation of the Minister of Natural Resources, directed the CER to issue CPCN OC-065, and various Amending Orders, to Trans Mountain to permit the Project to proceed, subject to 156 Conditions. As a result of the decision of the Federal Cabinet and the issuance of a CPCN by the CER on June 21, 2019, Trans Mountain resumed its planning and construction activities for the Project in 2020.

1.2 Routing

In December 2013, Trans Mountain submitted an Application for a corridor that varied in size and was generally 150 m wide centred over the existing TMPL 18 m wide right-of-way. The wider corridor assessed for the ESA was intended to provide flexibility for minor alignment adjustments during the detailed engineering and design phase. It was determined that, while it was possible to construct on or adjacent to the existing TMPL right-of-way for approximately two thirds of the proposed TMEP distance, it is not feasible in all cases due to engineering, constructability, residential and industrial development, geotechnical, environmental and socio-economic constraints, Indigenous interests or other reasons.

Major alternative corridors, including a western route option, were considered early in the Project planning process however ultimately rejected are described in Section 4.2 of the original ESA (Filing ID A3S1L4). Considering concerns raised by Coldwater Indian Band, several alternative corridors east and west of the Coldwater IR were studied and evaluated from an environmental and socio-economic perspective (Figure 4.2-5 and Table 4.2-5 of the original ESA; Filing ID A3S1L4), including the western route option. The Reroute is in a similar area as the western route option originally considered during the routing process although it has been refined since that time. The Reroute is located south of the originally considered western route option and extends further west.

Ultimately, Trans Mountain sought and obtained approval from the CER for a Project corridor that passed to the east of Coldwater IR, referred to as the Approved Route. In April 2018, as part of the Detailed Route Hearing Process, Coldwater Indian Band requested that Trans Mountain reconsider a western route option. In Coldwater Indian Band's view, the Approved Route:

- failed to minimize new disturbance in the Coldwater Valley
- failed to consider or avoid risks to the Coldwater aquifer which is the sole source of drinking water for 90% of residents on Coldwater IR when an alternative that poses no risks to the Coldwater aquifer was available but not meaningfully analyzed or considered
- selected a route that restrains future use of parts of Coldwater IR
- failed to consider whether the route minimizes impacts to Coldwater Indian Band's traditional uses and spiritual values (Filing ID A91119)

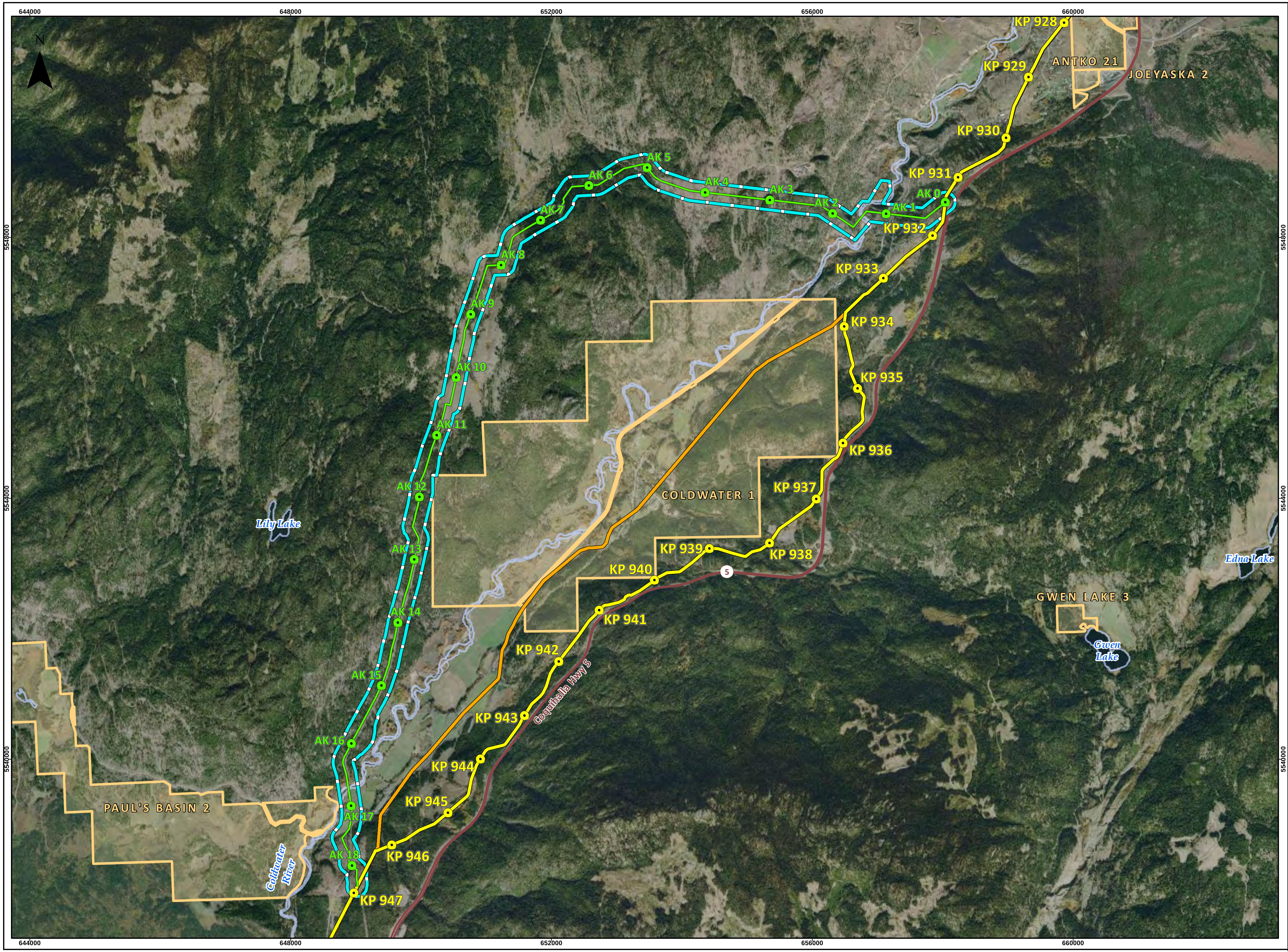
As a result of the Federal government's reinstated Phase III consultation process, Trans Mountain agreed to conduct a Feasibility Study of a modified western route option, formally called the West Alternative Route. Subsection 2.2 provides further details regarding the Phase III consultation process with Coldwater Indian Band.

The West Alternative Route or Reroute deviates from the current Project routing at KP 931.43 and parallels the south side of the Coldwater River for approximately 1.5 km before crossing the Coldwater River. It then turns upland before turning back southwest and crossing the Coldwater River a second time near Salem Creek. It then crosses Salem Creek and ties into the existing alignment at KP 946.88. Figure 1 provides an overview of the Reroute, including the corridor used in the assessment and its relationship to the Approved

Route. The Reroute is located on Crown land for 14.45 km and privately owned land for 3.91 km in the Thompson-Nicola Regional District, BC, near Merritt, BC. Approximately 14.3 km of the Reroute is parallel to other linear features (*e.g.,* Spectra Energy right-of-way, TELUS Fibre-Optic Transmission System) (Jacobs 2020b; Kinder Morgan 2012) and the remaining 3.99 km of the Reroute is greenfield (*i.e.*, not adjacent or parallel to any existing utility/road feature). Trans Mountain will utilize existing access roads and trails to the extent possible. Some roads may require upgrading prior to construction to ensure roads are safe for crew and equipment travel but will be decommissioned after construction with the exception of permanent access roads that will be required for ongoing access to the valve sites.

Trans Mountain is proposing two trenchless crossings of the Coldwater River – one at the north end and one at the south end of the Reroute. In the Western Feasibility Study, filed in April 2020, Trans Mountain put forward plans to use a horizontal directional drill (HDD) crossing method for both crossings. Since that time, and with the benefit of additional geotechnical drilling results, Trans Mountain has decided to implement alternate trenchless construction methods for the northern crossing due to challenging geotechnical conditions in that area. These alternative and preferred methods are by Direct Pipe® Installation (DPI) and, as a contingency should the DPI prove infeasible, micro-tunnelling. Trans Mountain's primary considerations are to install the crossing in a manner that avoids disturbance to the Coldwater River, while also reducing the technical risks of the crossing based on the geotechnical conditions.

A corridor approach was used for Reroute planning and assessment purposes to accommodate potential route realignments, if required, prior to finalizing the Reroute. The Reroute corridor is an approximate 300 m wide band generally centred on the pipeline centreline (*i.e.*, 150 m on both sides). There are select areas where a variable corridor width of up to 400 m was required to accommodate watercourse crossings or steep slopes. The corridor approach is used to allow for some flexibility during detailed design, execution planning and construction and to avoid environmental and cultural resources, if required, prior to finalizing the Reroute Footprint.The Reroute corridor has also been applied to the Reroute to accommodate locations where field information was unavailable due to lack of access to public lands or where input from the environmental, socio-economic, geotechnical or other disciplines would be beneficial to guide final placement of the proposed pipeline centreline and Reroute Footprint. A preliminary Reroute Footprint was applied within the Reroute corridor to support the field surveys and assessment, referred to herein as the "Reroute Footprint". It is recognized that corridor and route refinement is an iterative process that will continue throughout the review and detailed design phase of the Project as more information becomes available.



TRANS MOUNTAIN

FIGURE 1

OVERVIEW OF THE COLDWATER WEST ALTERNATIVE REROUTE

PROPOSED TRANS MOUNTAIN PIPELINE ULC

●	Coldwater Reroute Kilometre Post (AK)
●	TMEP Pipeline Kilometre Post (KP)
—	Coldwater Reroute
—	TMEP Pipeline
—	Existing TMPL Pipeline
—①—	Highway
▭	Coldwater Reroute 300m Corridor
▭	Indian Reserve
▭	Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 8, 2020; Transportation: BC MFLNRO 2012; Hydrology: BC MFLNRO 2008; First Nation Lands: Government of Canada 2018; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202008_MAP_CH2M_GEN_01194_REV2_FIG1

DATE	REFERENCE	REVISION
September 2020	CE771600	2
SCALE	PAGE SIZE	DISCIPLINE
1:55,000	11x17	GEN
DRAWN	CHECKED	DESIGN
SAB	DJN	CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01194_Rev2_Fig1.mxd

2.0 CONSULTATION AND ENGAGEMENT

Trans Mountain's consultation with the Appropriate Government Authorities, potentially affected Indigenous groups and affected landowners/tenants related to the West Alternative Reroute is presented in:

- Part VI - Indigenous Engagement, Section B – Summary of Engagement Efforts and Outcomes and Appendix C Consultation Logs; and
- Part VII - Stakeholder Engagement – Lands, Utilities and Related Stakeholder Engagement, Section C Stakeholder Engagement.

Since filing the Feasibility Study, Trans Mountain has been engaging with local stakeholders regarding the Reroute, including landowners, Appropriate Government Authorities and the public. Trans Mountain's stakeholder engagement program with respect to the Reroute has, thus far, included discussions with the Regional government which has jurisdiction over this area. On July 20, 2020, Trans Mountain notified the Thompson-Nicola Regional District of Trans Mountain's intention to explore an alternative route along the west side of the Coldwater Valley. Trans Mountain has not received feedback since issuing this notification.

2.1 Appropriate Government Authorities

Consultation with the Appropriate Government Authorities was conducted as part of the development of select technical data reports (TDRs) (refer to Appendices). For example, as part of ongoing consultation with Environment and Climate Change Canada (ECCC), Jacobs Consultancy Canada Inc. (Jacobs) has requested available critical habitat mapping or updates for the Reroute.

Various GIS data layers used to compile the Environmental Resource Maps and to support the TDRs and assessment were downloaded from the most current sources for the Reroute. Consultation with the BC Conservation Data Centre (BC CDC) regarding the Red- and Blue-listed plants *Lomatium dissectum* and *Potentilla gracilis var gracilis* occurred in July 2020 between the early and late rare plant surveys. With input from the Provincial biologist, the surveyors determined that neither of these species were observed on the Reroute (Donavan pers. comm. 2020).

2.2 Indigenous Engagement

Coldwater Indian Band views the Reroute as a potential mitigation measure for its concerns regarding potential impacts of the Project on the aquifer beneath Coldwater Indian Band Indian Reserve No. 1 and has expressed the view that the Reroute does not pose a perceived threat to the aquifer or the community's drinking water. During a meeting in March 2019, the Crown, Coldwater Indian Band and Trans Mountain agreed to further dialogue regarding route alternatives and to conduct a Feasibility Study of the West Alternative Route. This study was completed in consultation with Coldwater Indian Band, provided to Coldwater Indian Band on March 31, 2020 and filed with the CER on April 15, 2020 (Filing ID A7E8W7).

Indigenous groups were invited to participate and contribute to the Reroute reconnaissance in October 2019 to complete a preliminary review of the routing and identification of environmental and socio-economic features along the route. Members from Esh-kn-am (Coldwater Indian Band, Cooks Ferry Indian Band and Siska First Nation), Lower Nicola Indian Band and Scw'exmx Tribal Council (STC) (Nooaitch, Shackan) – previously known as Nicola Tribal Association – contributed to the reconnaissance effort.

In June/July 2020, members from Lower Nicola Indian Band, Shackan First Nation, Nicomen Band and Esh-kn-am (Coldwater Indian Band, Cooks Ferry Indian Band and Siska First Nation) took part in the biophysical field studies for the Reroute. Nlaka'pamux Nation Tribal Council (NNTC) representatives also accompanied the environmental professionals conducting biophysical field studies for the Reroute. In particular, specialists from A.E.W. Limited Partnership (AEW), a joint venture between NNTC and SLR Consulting Ltd., reviewed the wildlife survey methodology prior to conducting the wildlife surveys and collaborated on the approach. A meeting was held between Trans Mountain, Jacobs and AEW representatives to discuss the methodologies and to discuss wildlife species to be included in the surveys. A draft of the Assessment Methodology presented in Appendix F was provided to NNTC and Coldwater Indian Band for review and comment early on in the review process.

Indigenous groups were invited to be part of the archaeological field work in May 2020. Members from Lower Nicola Indian Band, STC, Upper Nicola Indian Band, Esh-kn-am (Coldwater Indian Band, Cooks Ferry Indian Band and Siska First Nation) and Nooaitch expressed interest and participated in the summer and fall 2020 archaeological field investigations.

In addition, Coldwater Indian Band and NNTC were provided a draft of the ESA as well as the Vegetation, Fisheries, Wetland, Wildlife and Wildlife Habitat, and Soils TDRs in early- to mid- August 2020. Trans Mountain received letter responses and comments from Coldwater Indian Band and NNTC on the draft ESA and TDRs. Trans Mountain, with the support of Jacobs, considered and reviewed all comments, discussed them with Coldwater Indian Band and NNTC and incorporated the majority of comments into the Variance Application and ESA. Where comments were not incorporated, a rationale was provided, and a further discussion took place with the respective community representatives. Trans Mountain formally responded to Coldwater Indian Band on September 8, 2020 and NNTC on September 10, 2020 and continued to engage with the communities as Trans Mountain worked to finalize the Variance Application and ESA. Updated versions of the ESA and TDRs were issued to Coldwater Indian Band and NNTC on or around September 23, 2020 outlining changes to the reports since they last were issued in August. Trans Mountain is committed to ongoing dialogue and discussions with potentially affected Indigenous groups, including Coldwater Indian Band and NNTC, through the duration of the regulatory review process and the lifecycle of the Project.

3.0 ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

The environmental and socio-economic issues and concerns along the Reroute are consistent with those associated with the construction and operation of the Project. These were identified and assessed in the original ESA and related filings:

- Volumes 5A and 5B of the Facilities Application (Filing ID A56004)
- ESA Update (Filing ID A4F4Z3)
- Responses to Information Request No. 2.041 (Filing ID A3Z4T9)
- Information Request No. 3.025 (Filing ID A4H1V2)

The assessment team reviewed the setting (current state of the environment) for each of the biophysical and socio-economic elements (Table 1) to evaluate whether the Reroute could have any new or unique interactions that would change the indicators, potential or residual effects, cumulative effects or significance conclusions of the original ESA and related filings (Table 3).

The environmental effects assessment of the Reroute is a collaborative effort of several qualified professionals with element-specific expertise, under the guidance of representatives of qualified experts.

TABLE 1

ENVIRONMENTAL EFFECTS ASSESSMENT TEAM

Environmental Element	Assessment Team
Physical and Meteorological Environment	Jacobs and BGC
Soil and Soil Productivity	McTavish and Jacobs
Water Quality and Quantity	Waterline and Jacobs
Fish and Fish Habitat	Jacobs and Triton
Wetland Loss or Alteration	Jacobs
Vegetation	Jacobs
Species at Risk	Jacobs
Wildlife and Wildlife Habitat	Jacobs
Heritage Resources	Stantec
Traditional Land and Resource Use (TLRU)	Jacobs
Accidents and Malfunctions	Jacobs
Effects of the Environment on the Project	Jacobs and BGC

Notes: BGC = BGC Engineering Inc.
Jacobs = Jacobs Consultancy Canada Inc.
McTavish = McTavish Resource & Management Consultants Ltd
Triton =Triton Environmental Consultants
Waterline = Waterline Resources Inc.

The review and assessment considered not only the information collected during the original ESA and related filings but also the information collected since. This included new critical habitat information, new consultation feedback, the NEB Recommendation Report (Filing ID A77045), the Reconsideration Hearing (MH-052-2018) and Phase III Consultation (Government of Canada 2019a). The assessment considered whether any of the new information affected the conclusions of the original ESA and related filings, which was previously approved and meets the requirements of the Filing Manual Guide A (CER 2020).

On August 28, 2019, the *CER Act* came into force, replacing the *National Energy Board Act*. Every decision or order made by the NEB is considered to have been made under the *CER Act* and may be enforced as such. Every certificate, license or permit issued by the NEB is considered to have been issued under the *CER Act*. Those instruments remain in force for the remainder of the period during which they would have been in force had the *CER Act* not come into force.

As such, the CER Interim Guidance and Early Engagement Guide was reviewed and considered in the context of the Reroute. Early engagement can help to identify and address issues, foster discussions and assist in the review process; however, in consideration of the level of consultation and engagement conducted to date, including the recent Phase III and Phase IV consultation and specific Reroute engagement and the existing Project-specific Condition Plans, no new or additional potential interactions or effects specific to the new factors in the legislation (*e.g.*, gender-based analysis plus [GBA+], effects on Indigenous rights, greenhouse gas [GHG] emissions and climate change and climate change commitments and environmental obligations) are anticipated to occur as a result of construction or operation of the Reroute.

The current Project-specific Conditions potentially applicable to the Reroute that are anticipated to reduce or alleviate potential effects regarding the new factors include:

- Condition 13: Socio-economic Effect Monitoring Plan (GBA+, effects on Indigenous rights)
- Condition 16: Quantitative Geohazard Frequency Assessment (climate change commitments)
- Condition 40: Rare Ecological Community and Rare Plant Population Management Plan (effects on Indigenous rights)
- Condition 41: Wetland Survey and Mitigation Plan (environmental obligations [*e.g.*, Federal Policy on Wetland Conservation])
- Condition 43: Watercourse Crossing Inventory (effects on Indigenous rights)
- Condition 44: Wildlife Species at Risk Mitigation and Habitat Restoration Plans (environmental obligations [*e.g.*, *Species at Risk Act* {*SARA*}], effects on Indigenous rights)
- Condition 45: Weed and Vegetation Management Plan (effects on Indigenous rights)
- Condition 47: Access Management Plans (included with Condition 72)
- Condition 48: Navigation and Navigation Safety Plan (effects on Indigenous rights)
- Condition 59: Worker Accommodation Strategy (GBA+)
- Condition 65: Hydrology – Notable Watercourse Crossings (climate change commitments)
- Condition 71: Riparian Habitat Management Plan (effects on Indigenous rights)
- Condition 72: Pipeline Environmental Protection Plan (effects on Indigenous rights, climate change commitments)
- Condition 74: Horizontal Directional Drilling (HDD) Noise Management Plan
- Condition 92: Updates Under the *SARA* (environmental obligations)
- Condition 93: Water Well Inventory (effects on Indigenous rights)
- Condition 94: Consultation reports – protection of Municipal water courses (effects on Indigenous rights)
- Condition 96: Reports on Engagement with Indigenous Groups (effects on Indigenous rights)
- Condition 97: Traditional Land Use Investigation Report (effects on Indigenous rights)
- Condition 98: Plan for Indigenous Group Participation in Construction Monitoring (effects on Indigenous rights)

- Condition 100: Heritage Resources and Sacred and Cultural Sites Plan (effects on Indigenous rights)
- Condition 110: Authorization Under Paragraph 35(2)(b) of the *Fisheries Act* and *SARA* Permits – Pipeline (environmental obligations)
- Condition 140: Post-construction Greenhouse Gas Assessment Report (climate change commitments)
- Condition 142: GHG Offset Plan – Project Construction (climate change commitments)
- Condition 145: Community Benefit Program Progress Report (effects of Indigenous rights)
- Condition 147: Natural Hazard Assessment (climate change commitments)

3.1 Environmental and Socio-Economic Setting

The environmental and socio-economic setting (*i.e.*, the current state of the environment) along the Reroute are described in Table 2. Information collected for the setting was obtained from discipline-specific field surveys conducted in 2019 and 2020, a review of the original ESA, a desktop review of relevant literature and analysis of existing data.

TABLE 2

ENVIRONMENTAL AND SOCIO-ECONOMIC SETTING

Environmental and Socio-economic Elements	Summary of Considerations
Physical and Meteorological Environment	• The Reroute is located within the Interior Plateau Physiographic Region which is characterized by gentle to moderately sloping rolling uplands with rounded ridges and summits, valleys deeply dissecting the plateau, terraces, fluvial plains, fans and cones (Demarchi 2011; Holland 1976). • The Reroute is underlain by nonmarine fault-trough clastics (including Upper Cretaceous strata), shale, siltstone, sandstone, conglomerate, local lignite and marl and dacitic volcanics (Journeay et al. 2000). • Elevation along the Reroute varies from approximately 700 m to 1,100 m (Dynamic Risk 2015). • The west valley slope of Coldwater River crossing #1a at the north end of the Reroute contains areas with the potential for landslides (BGC 2020). Most of the Reroute is located on moderately to gently sloping terrain (<26°) with steep slopes (>35°) less than 50 m long occurring on the sides of meltwater channels and along the Coldwater River Valley. • Potential geohazards include slope instability, landslide and flooding. • Following field reconnaissance, one geohazard site was identified along the west valley slope of Coldwater River crossing #1a. This slope is approximately 120 m high, 700 m long and has an average gradient of 11° (BGC 2020). • The Reroute encounters lands considered to have a medium risk for natural hazard potential from AK 1.43 to AK 2.00. Terrain stability and natural hazard (*e.g.,* rock fall, debris flow, debris floods, floods, channel changes, rock avalanches) mapping completed for the Reroute identified glaciofluvial, fluvial, till, colluvial, glaciolacustrine, anthropogenic and organic surface materials and bedrock (BGC 2020). It was determined that the likelihood of occurrence of hazards along the Reroute ranges from low to high. • Bedrock is encountered from approximately AK 2.10 to AK 2.56, AK 6.40 to AK 6.65, AK 11.20 to AK 11.90, and AK 15.50 to AK 15.65. • The majority (*i.e.*, 84%) of the Reroute intersects stratigraphic units that have a low to minimal likelihood of acid rock drainage (ARD). However, one stratigraphic unit, Princeton Group – undivided sediments - are known to have a higher likelihood of ARD, with a current classification of moderate likelihood. The Princeton Group sediments are encountered at two locations at AK 1.05 to AK 2.35 and from AK 17. 99 to AK 18.31. • The average annual temperature at the Merritt, BC ECCC weather station is 7.8°C. On average, July and August are the warmest months and December and January are the coldest. Average annual precipitation is 321.1 mm including 254.5 mm of rainfall and 66.7 mm of snowfall (ECCC 2019a).
Soil and Soil Productivity	• Land use along the Reroute is a mixture of Crown land and private land (BC MFLNRORD 2020a). • Approximately 2.77 km (15.1%) of the Reroute is located on Agricultural Land Reserve (ALR) lands (ALC 2020). • Natural Resources Canada considers unprotected soils along the Reroute as having very low wind erosion risk with low climactic sensitivity. Some areas along the Reroute encounter areas where risk is considered negligible and unrated (NRCan 2010). • A search of the Federal databases did not return any results of a spill or contaminated sites within 500 m of either side of the Reroute (CER 2020). • A search of the BC Provincial data returned two remediation sites within 500 m of the Reroute (approximately 300 m and 420 m away) (BC ENV 2019a). • A soil survey was conducted along the Reroute in July 2020. The following soils are present on the Reroute Footprint and within the Reroute corridor: Britton, Connaly, Frances, Godey, Gisborne, Kane, McQueen, Timber and Trachyte. The dominant soil type is Timber. • To help support and inform the soil and soil productivity field studies, participants from STC (Nooaitch Indian Band, Shackan Indian Band), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry Indian Band, Coldwater Indian Band, Siska First Nation) accompanied the Jacobs field crew to identify environmental, cultural and social resources along the Reroute.

TABLE 2 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Water Quality and Quantity	• The Reroute is located in the Lower Nicola River Watershed. • In the fall of 2019 and summer of 2020, 28 potential watercourses were investigated in the field. • The Reroute crosses 28 potential watercourses, including Salem Creek and two crossings of the Coldwater River. The Reroute also crosses 4 wetlands and 8 flood associations. • Access roads to support the Reroute cross 21 watercourses. • Trenchless crossings (DPI and HDD) are recommended and planned for both Coldwater River crossings. • The Reroute is located on the opposite side of the Coldwater Valley from the Coldwater IR, in a different watershed from that used for the community's water supply. • The Reroute does not encounter any mapped aquifers. A hydrogeological study completed in May 2020 found that the Reroute presents minimal risk to groundwater supplies, given the large distance from supply wells to the Reroute alignment and that all supply wells aside from one are located on the opposite (eastern) side of the Coldwater River. • The Paul's Basin Indian Reserve No.2 is located southwest of the Coldwater River crossing #2. A desktop review of the BC Groundwater Database was conducted to identify any data on groundwater conditions in Paul's Basin Indian Reserve No. 2. The area is generally unpopulated, and there is no information regarding registered groundwater wells, springs or potable water sources. Paul's Basin Indian Reserve No.2 is upgradient of the Reroute, which is situated approximately 260 m east of the reserve at its closest point. • There are two groundwater wells within 150 m of the Reroute. The closest water well is 77 m from centreline (BC ENV 2019b) and is a water supply well (Tag #115219) near the Coldwater River crossing #2. Water well Tag #115219 is licenced under the BC *Water Sustainability Act* to divert groundwater for livestock watering use. • Two valves are being considered on either side of each of the proposed Coldwater River crossings (four valves total) and the location will be based on the results of a release volume analysis. • To help support and inform the water quality and quantity field studies, participants from Esh-Kn-Am, STC, Lower Nicola Indian Band and Nooaitch Indian Band accompanied the Jacobs and Triton field crew in field investigations of water quality and quantity in surface water features along the Reroute.
Air and GHG Emissions	• Existing factors affecting air quality include agricultural operations, vehicle traffic and residential activities. • The nearest residence is located approximately 49 m from AK 16.9.
Acoustic Environment	• Sources of existing sound include traffic travelling along Coldwater Road and back roads, off-road vehicle use, activities associated with the proposed Merritt Gateway 286 (CIB 2020) project and natural sound (*e.g.,* wind, wildlife). • Prediction results in the Terrestrial Noise and Vibration Technical Report in Volume 5C of the Facilities Application (Filing ID A3S1T7) indicate there is potential for high magnitude effects at residences within 300 m of the pipeline corridor due to construction sound emissions. The nearest receptor is located approximately 49 m from AK 16.9. The nearest receptors to trenchless activities are approximately 359 m from Coldwater River crossing #1a and 207 m from Coldwater River crossing #2 (Jacobs 2020a). • The Reroute is located outside of the City of Merritt and is not subject to any noise abatement bylaws. The Thompson-Nicola Regional District currently has no bylaws relating to noise (TNRD 2015). It is anticipated that construction activities will comply with the BC Noise Control Best Practices Guideline (BC OGC 2018).
Fish and Fish Habitat	• Known fish-bearing watercourses along the Reroute include the Coldwater River (crossed twice), a side channel of the Coldwater River and Salem Creek. Other tributaries to the Coldwater River have low potential for fish habitat due to steep slopes (dry upland sites) and seasonal/ephemeral flows. • Based on field investigations complete to date, the 28 watercourses and drainages verified along the Reroute include: – 2 high sensitivity fish-bearing watercourse crossings (two crossings of the Coldwater River) – 1 low sensitivity fish-bearing watercourse crossing (Salem Creek) – 25 nonfish-bearing drainages including 6 non-classified drainages, 1 S6 watercourse and 18 classified as no visible channel. • Field investigations on the 21 potential watercourse crossings along access roads identified 21 nonfish-bearing drainages including 10 non-classified drainages and 11 non-visible channels. • Irrigation withdrawals and the loss of riparian vegetation associated with ranching and agriculture have contributed to several water quality problems and impacts to salmon spawning and rearing in the Lower Nicola Watershed. Other activities may affect the fish resources in the Lower Nicola River Watershed include logging in headwater regions, effluent loading from industrial activities and mining (Millar et al. 1997). • There are no species listed under Schedule 1 of the *SARA* or species at risk critical habitat known to occur in the Coldwater River or tributaries within the study areas (ECCC 2019b).

TABLE 2 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Fish and Fish Habitat *(cont'd)*	• Indicator species for BC were previously identified as important species of cultural, recreational, ecological and/or Indigenous concern that are distributed widely throughout the Province and encountered frequently in watercourses along the proposed pipeline/power line corridors, access roads and areas downstream, as supported by fish and fish habitat assessments and/or literature reviews. While it is understood the term 'cultural, recreational, and Aboriginal' or 'CRA' species is no longer in use under the new *Fisheries Act* provisions, these species still tend to be of higher management concern, as they are deemed important for Regional fisheries and/or Indigenous peoples. Indicator species relevant to the Reroute include coho salmon, chinook salmon, steelhead, rainbow trout and bull trout/Dolly Varden. Listed indicator species include bull trout (Blue-listed Species of Concern in BC) and Interior Fraser River coho, Lower Thompson sub-populations (Endangered by Committee on the Status of Endangered Wildlife in Canada [COSEWIC]). • Additional detail regarding fish species distribution and historical fish and fish habitat information is provided in the Fisheries Technical Data Report (TDR) for the Coldwater Reroute in Appendix B of this ESA. • To help support and inform the fish and fish habitat field studies, participants from Esh-Kn-Am, STC, Lower Nicola Indian Band and Nooaitch Indian Band accompanied the Triton field crew in field investigations of fish and fish habitat potential along the Reroute. **Coldwater River and Side Channel** • The Coldwater River is an important contributor of coho salmon, early-run chinook salmon and steelhead in the Nicola River Watershed (LGL 2007). Indicator species that occur in the Coldwater River include coho salmon, chinook salmon, steelhead, rainbow trout and bull trout/Dolly Varden. Other sportfish include mountain whitefish. Non-sportfish species in the Coldwater River include longnose dace, leopard dace, sucker species, sculpin species, redside shiner and Pacific lamprey (Appendix B of this ESA). • The least risk biological window is July 22 to August 12 and July 22 to October 31 for the Coldwater River and the side channel, respectively. **Salem Creek** • Known fish species within Salem Creek include rainbow trout. The Provincial instream work window is July 22 to August 1.
Vegetation	• Land cover along the Reroute centreline includes: wetland (58 m), riparian (1,086 m), river (91 m), shrubs (1,215 m), forest (13,680 m), hay (712 m), tame pasture (1,861 m) and disturbances including roads and existing rights-of-way (28 m) (Opus Stewart Weir 2020). • The Reroute crosses three biogeoclimatic (BGC) subzone variants, including Thompson Very Hot Ponderosa Pine Variant (PPxh2), Okanagan Very Hot Interior Douglas-fir Variant (IDFxh1) and Thompson Very Hot Interior Douglas-fir Variant (IDFxh2) (BC MFLNRO 2018). All three subzone variants are characterized by a warm, dry climate and long growing seasons (Lloyd et al. 1990). The Reroute is located within the Cascade Natural Resource District. • All Red- and Blue-listed vascular plants, bryophytes and lichens in the BG, PP and IDF Zones and Cascade Natural Resource District are included in Appendix A of the ESA. Red- and Blue-listed rare ecological communities in the PPxh2, IDFxh1, and IDFxh2 subzones and Cascade Natural Resource District are included in Appendix A of the ESA. • There are 11 vegetation species at risk (*i.e.*, those listed under Schedule 1 of *SARA* or by COSEWIC) known to occur in the PP and IDF Zones and Cascade Natural Resource District (Appendix A of this ESA). • There are three ecological communities listed under the *Forest and Range Practices Act* with potential to occur in the PPxh2, IDFxh1, and IDFxh2 subzones and Cascades Natural Resource District (Appendix A of this ESA). • BC CDC occurrences of Red- and Blue-listed plants, lichens and ecological communities within 1 km of the Reroute were reviewed and no BC CDC records were identified (BC MFLNRORD 2019c, 2019d, 2020c). • Vegetation surveys of the Reroute were conducted in June 10 to 14 and July 22 to 31, 2020. These surveys encountered one occurrence of BC CDC-listed moss species cylindrical candlesnuffer moss (*Encalypta affinis* spp. *affinis*, S2S3, Blue list), one BC CDC-listed lichen species rockfrog (*Xanthoparmelia camtschadalis*, S1S2, Red list) and seven occurrences of BC CDC-tracked ecological communities within the corridor. These communities included: – two observations of Bebb's willow / bluejoint reedgrass (*Salix bebbiana / Calamagrostis canadensis,* S3, Blue list) within the corridor but not crossed by the centreline – four observations of black cottonwood / common snowberry – roses (*Populus trichocarpa / Symphoricarpos albus – Rosa* spp., S1, Red list) within the corridor, and crossed by the centreline four times – two observations of hard-stemmed bulrush (*Xanthoparmelia camtschadalis*, S3, Blue list) within the corridor but not crossed by the centreline – two observations of a common cattail Marsh (*Typha latifolia* Marsh, S3, Blue list) within the corridor but not crossed by the centreline – two observations of Douglas-fir / Douglas maple - red-osier dogwood (*Pseudotsuga menziesii / Acer glabrum - Cornus sericea*, S2, Red list) within the corrido and crossed by the centreline twice – six observations of trembling aspen / common snowberry / mountain sweet-cicely (*Populus tremuloides / Symphoricarpos albus / Osmorhiza berteroi,* S1, Red) within the corridor and crossed by the centreline six times – two observations of water birch / roses (*Betula occidentalis / Rosa* spp., S1, Red list) within the corridor and crossed by the centreline twice

TABLE 2 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Vegetation *(cont'd)*	• Based on aerial imagery and Vegetation Resources Inventory mapping attribute analysis, the Reroute on the east side of the Coldwater River crossing #1a at AK 1.4 has the potential to interact with a floodplain ecosystem similar to a middle bench floodplain, such as a cottonwood – snowberry – rose community (Fm01). • No COSEWIC- or *SARA*-listed species were observed along the Reroute during the vegetation surveys. The water birch / roses ecological community is listed on the *Forest and Range Practices Act*. • No critical habitat for vegetation species at risk is present within the Reroute corridor (ECCC 2019b). • The Reroute is located within the area administered by Thompson-Nicola Invasive Plant Management Committee (TNIPMC). • The Reroute centreline also follows transmission line rights-of-way and roads from approximately AK 8.2 to 16.7 leading to abundant non-native and invasive vegetation occurrences. Cleared areas and agricultural land occurs from AK 16.7 to AK 17.4. • Invasive plant species observed on along the Reroute corridor during field work included Provincially listed species: Canada thistle, common hound's-tongue, Dalmatian toadflax, scentless chamomile, and spotted knapweed; and Regionally Noxious Weeds: great burdock, oxeye daisy, and sulphur cinquefoil. Numerous other non-native species were observed and are included in the Vegetation TDR. • Burdock species, Dalmatian toadflax, common hound's-tongue, spotted knapweed, and sulphur cinquefoil are also listed by the TNIPMC as among the current species most threatening to the Thompson-Nicola Regional District (TNIPMC 2020). • Four non-legal Old Growth Management Areas (OGMAs) are traversed by the Reroute centreline and six non-legal OGMAs are traversed by the Reroute corridor (BC MFLNRORD 2020a). No legal OGMAs are expected to be impacted by the Reroute corridor (BC MFLNRORD 2020a). • To help support and inform the vegetation field studies, participants from STC (Nooaitch Indian Band, Shackan Indian Band), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry Indian Band, Coldwater Indian Band, Siska First Nation) accompanied the Jacobs field crew to identify environmental, cultural and social resources along the Reroute.
Wetlands	• The Reroute crosses two BGC zones: the PP BGC zone and the BG BGC zone. The PP BGC zone is located in the southern portion of BC and is the driest and warmest of the forest zones and winters are cool with light, intermittent snow cover. Ponderosa pine dominates forested areas with a grassy understory. Wetlands are not common within this zone; however, moisture loving plant species can be found in seepages and in riparian areas (BC MOF 1998a). The BG BGC zone is located in south central BC and lies within the rainshadow of the Coast and Cascade mountains, which results in the BG BGC zone being one of BC's warmest and driest areas. Many drought tolerant plants and shrubs are found within the BG BGC zone. The most common wetland type found within this zone are marshes dominated by cattail and bulrush species. Saline meadows are also present in shallow basins and associated with ponds and lakes (BC MOF 1998b). • The environmental field reconnaissance and wetland field survey determined that four wetlands and eight flood associations are encountered by the Reroute Footprint. A total of ten wetlands and nine flood associations are encountered by the Reroute corridor. Three wetlands are encountered by the Reroute access road footprint, one of which is also encountered by the Reroute Footprint. No lakes are encountered. Details regarding wetlands and flood associations encountered by the Reroute are provided in Appendix C of the ESA. The distribution of wetlands along the Reroute is shown on the Environmental Resource Maps (Appendix G of the ESA). • To help support and inform the field studies, participants from STC (Nooaitch Indian Band, Shackan Indian Band), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry Indian Band, Coldwater Indian Band, Siska First Nation) accompanied the Jacobs field crew to identify environmental, cultural and social resources along the Reroute.
Wildlife and Wildlife Habitat	• The Reroute crosses areas identified by ECCC as critical habitat for Williamson's sapsucker (ECCC 2019d) for a total length of approximately 11.04 km and area of 75.22 ha (based on the Reroute Footprint) (see Figure 2 and Table 3 in Appendix D of this ESA and the Environmental Resource Maps in Appendix G). Roads planned for the Reroute interact with critical habitat for Williamson's sapsucker for a total length of approximately 9.13 km and area of 17.53 ha. The Wildlife Local Study Area (LSA) intersects Lewis's woodpecker critical habitat, but it is located 394 m north of the Reroute corridor (near AK 0) and is not expected to interact with the Reroute. Early Draft critical habitat mapping for western screech-owl, *macfarlanei* ssp. is not currently available along the Reroute. As part of ongoing consultation with ECCC, Trans Mountain has requested available critical habitat mapping or updates for the Project, including the Reroute. • The Reroute crosses an approved Ungulate Winter Range (UWR) for mule deer (U-3-003) for a total of 14.17 km and area of 102.18 ha (based on the Reroute Footprint) and approved Wildlife Habitat Areas (WHAs) for Williamson's sapsucker (WHA 3-131, WHA 3-132, WHA 3-134, WHA 3-211, WHA 3-212, WHA 3-215) for a total of 3.22 km and area of 20.433 ha (based on the Reroute Footprint) (Tables 4 and 5 in Appendix D of this ESA) [BC ENV 2020; BC MFLNRORD 2020b]. The majority (88%) of the length of the WHAs crossed by the Reroute centreline is also located within identified critical habitat for Williamson's sapsucker. Based on the Reroute Footprint, construction of the Reroute will affect approximately 3% of the area of WHA 3-131, 6% of WHA 3-132, 13% of WHA 3-134, 0.3% of WHA 3-211, 13% of WHA 3-212 and 10% of WHA 3-214, and <0.1% of the area of UWR U-3-003. Based on the Reroute Footprint, construction of the Reroute will affect approximately 0.2% of the area of Williamson's sapsucker critical habitat identified in the Western Area of Occupancy (ECCC 2016). Roads planned for the Reroute interact with WHAs (3-132, 3-134, 3-212 and 3-215) for Williamson's sapsucker for a total length of approximately 2.98 km and interact with UWR U-3-003 for a total length of approximately 15.79 km.

TABLE 2 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Wildlife and Wildlife Habitat *(cont'd)*	• The Wildlife LSA does not cross any other Provincially identified wildlife areas (*e.g.,* caribou range or caribou Local Population Units [BC MOE 2010; Environment Canada 2014], proposed UWRs [BC MFLNRORD 2019a], or proposed WHAs [BC MFLNRORD 2019b]). The Wildlife LSA is located entirely within an Extirpated Grizzly Bear Population Unit (BC MOE 2012). The Wildlife LSA is not located within any parks or protected areas (BC Parks 2019), National Wildlife Areas (ECCC 2019c), Migratory Bird Sanctuaries (ECCC 2017), Important Bird Areas (Bird Studies Canada 2015), Western Hemisphere Shorebird Reserves (WHSRN 2019) or Ramsar wetlands (Bureau of the Convention on Wetlands 2016). • Wildlife species listed under Schedule 1 of the *SARA* or by COSEWIC with the potential to interact with the Reroute location are listed in Appendix D of this ESA. • A search of the BC CDC database identified occurrences of the following two Federally listed wildlife species at risk within 1 km of the Reroute corridor (BC MFLNRORD 2019d): − western screech-owl, *macfarlanei* subspecies (ssp.) (Threatened on Schedule 1 of *SARA* and by COSEWIC) − Williamson's sapsucker (Endangered on Schedule 1 of *SARA* and by COSEWIC). • A field reconnaissance to review wildlife habitat in select areas along the Reroute was conducted from October 22 to 24, 2019. The field reconnaissance included ground searches to identify wildlife habitat features (*e.g.*, stick nests, mineral licks and dens) important to wildlife that may be affected by the Reroute, and a review of habitat suitability for species at risk, including the biophysical attributes of critical habitat for Williamson's sapsucker in areas that cross critical habitat identified by ECCC. • Field surveys were conducted from June 8 to June 18, 2020. These included amphibian surveys, Williamson sapsucker surveys (including a review of the biophysical attributes of critical habitat), American badger and reptile habitat feature surveys, common nighthawk and short-eared owl surveys, owl call playback surveys and spotted bat habitat reconnaissance. All incidental wildlife observations (*e.g.,* visual/auditory), evidence of wildlife use, and wildlife habitat features (*e.g.,* stick nests, dens, mineral licks, hibernacula or roosts) were recorded during the wildlife surveys and when travelling to and from survey locations. • Wildlife habitat along the Reroute is generally characterized by forest dominated by Douglas-fir and ponderosa pine stands, with areas of tame pasture. No wildlife habitat features (*e.g.*, stick nests, mineral licks and dens) were observed during the field reconnaissance in October 2019. In June 2020, amphibians were observed at nine wetlands/low-lying wet areas within or adjacent to the Reroute corridor. Suitable hibernacula habitat for garter snakes was observed along a rocky slope located approximately 42 m south of the centreline near AK 2.30; however, there was no evidence of use or snake observations in the area. Eight garter snakes (unidentified species) and one shed were observed approximately 41 m west of the centreline near AK 9.30, indicating that a hibernaculum (i.e., over-wintering den) may be in the vicinity, though no obvious hibernacula habitat/features were noted. A nest tree (snag) was identified approximately 18 m north of the centreline near AK 3.04; evidence of previous owl use was observed around the base of the snag (old pellets and bones). Five potential mammal dens (unknown species) were incidentally observed during the wildlife field surveys in June 2020. No sign or evidence of recent use was observed at the dens. • Four species at risk were observed during wildlife field surveys in June 2020, including: common nighthawk (Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC), olive-sided flycatcher (Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC), Williamson's sapsucker (Endangered on Schedule 1 of *SARA* and by COSEWIC) and western toad (Special Concern on Schedule 1 of *SARA* and by COSEWIC). • During wildlife surveys in June 2020, Williamson's sapsuckers were observed at 16 Williamson's sapsucker survey sites and incidentally at two additional locations. Biophysical attributes of Williamson's sapsucker critical habitat were present within critical habitat and WHAs crossed by the Reroute. • To help support and inform the wildlife and wildlife habitat field studies, participants from STC (Nooaitch Indian Band, Shackan Indian Band), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry Indian Band, Coldwater Indian Band, Siska First Nation) accompanied the field crew to identify environmental, cultural and social resources along the Reroute.
Species at Risk	• Species at risk are those species listed Federally on Schedule 1 of the *SARA* or by COSEWIC (*e.g.*, aquatic, vegetation or wildlife species). • See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.
Heritage Resources	• The Reroute was assessed as having high archaeological potential during desktop review and an archaeological impact assessment (AIA) was recommended. • AIA field studies began on July 6, 2020 and are anticipated to continue into the fall of 2020. • AIA field work is being conducted under a Heritage Inspection Permit issued by the Archaeology Branch of the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD) and with the participation of several Indigenous groups and organizations including Esh-kn-am, Lower Nicola Indian Band, Upper Nicola Band, Nooaitch, and STC. • Several areas of high archaeological potential have been confirmed in the field and two new archaeological sites have been documented. • Upon completion of the AIA, a report will be produced detailing results of the study and will provide management recommendations for all identified archaeological sites. • The AIA report will be provided to the Archaeology Branch of the BC MFLNRORD and applicable Indigenous groups.

TABLE 2 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Indigenous Traditional Land and Resource Use (TLRU)	• Information on Indigenous practices related to fish and fish habitat are provided in Section 4.2.3 of Fisheries (BC) Technical Report 5C-7 in Volume 5C (Filing ID A3S2C1). • TLRU activities and sites have been identified along the Reroute by Coldwater Indian Band. Other Indigenous groups have confidentially identified TLRU activities (including plant gathering, hunting and fishing) and sites along the Reroute. • Coldwater Indian Band has indicated there are sacred sites including ancestral places (burials), ceremonial areas, sweat lodges, ritual bathing sites, vision quest locations, sun dance grounds, sacred waterfalls, mountains, archaeological pit house sites, locations inhabited by spirit beings, including the 'little people' as well as special avoidance areas that may be present on the Reroute (Filing IDs A4Q0K1, A6Y0U2 PDF; p. 14-15*)*. To date, Coldwater Indian Band has identified nine Traditional Land Use sites on the Reroute Footprint, including hunting and fishing sites, two sacred sites and one cultural site.
Social and Cultural Well-being	• The social and cultural well-being setting for the Reroute is consistent with that of the Approved Route.
Human Occupancy and Resource Use (HORU)	• Lands affected by the Reroute are primarily Crown land (79% or 14.45 km) with the remainder (21% or 3.91 km) on private land (BC MFLNRORD 2020e). • Most of the Crown lands are occupied by grazing tenures. • A portion of the Reroute is governed by the Nicola Valley Official Community Plan (OCP), and the segment of the Reroute within the Nicola Valley OCP is zoned for agriculture use and retail/service commercial (TNRD 2011). • The Reroute crosses six private parcels of land. The nearest residence is located approximately 49 m from AK 16.9. • The Reroute crosses four rural residential properties and two agricultural properties. • The Reroute does not cross any Reserves (Government of Canada 2019b). The Coldwater community of the Coldwater IR is located approximately 134 m from AK 11.6. Paul's Basin Indian Reserve No.2 is located approximately 167 m from AK 16.8. • Land cover along the Reroute centreline includes: wetland (58 m), riparian (1,086 m), river (91 m), shrubs (1,215 m), forest (13,680 m), hay (712 m), tame pasture (1,861 m) and disturbances including roads and existing rights-of-way (28 m) (Opus Stewart Weir 2020). • Existing land uses surrounding the Reroute include agriculture, hunting and trapping, fishing and recreational use (*e.g.,* hiking, cycling, camping, horseback riding, cross country skiing and off-highway vehicle use). • Approximately 2.77 km (15.1%) of the Reroute is located on ALR lands (ALC 2020). • The Reroute corridor does not cross any parks and protected areas. No lands under Parks Canada jurisdiction, conservation areas, International Biological Program sites or other ecological reserves or preserves are located in the HORU LSA. • There are nine trails, including the Kettle Valley Rail Trail, crossed by the Reroute (BC MFLNRO 2008a). Tourism and outdoor recreation opportunities are abundant throughout the HORU LSA and Regional Study Area (BC MFLNRO 2008b). The Merritt area attracts tourists for hiking, biking and fishing (Tourism Merritt 2019). • The Reroute is located in the Merritt Timber Supply Area (TSA). Approximately 806,000 ha (71%) of the Merritt TSA is considered productive Crown forest land base (BC MFLNRORD 2019d). As of March 30, 2016, the Annual Allowable Cut (AAC) for the Merritt TSA was 1,500,000 m^3. Effective March 30, 2021 the AAC will be 1,200,000 m^3 (BC MFLNRORD 2019d). The Reroute crosses 0.7 km of woodlots. • The Reroute is located in BC Resource Management Region 3 (Thompson-Nicola), Nicola Management Unit (3-13) for hunting and fishing management. For hunting, open season timing varies depending on the Management Unit and the species, but most hunting occurs from early September to December (BC ENV 2019c). • The Reroute crosses two trapping tenures (BC ENV 2019c). The Reroute is not located in a guide outfitter area. • The Reroute is located in the Thompson and South Thompson River watersheds. The Reroute does not cross any community watersheds. • The Reroute does not cross any mapped aquifers. There are two groundwater wells within 150 m of the Reroute. The closest water well is 77 m from centreline (BC ENV 2019b) and is a water supply well (Tag #115219) near the Coldwater River crossing #2. Water well Tag #115219 is licenced under the BC *Water Sustainability Act* to divert groundwater for livestock watering use. • No bylaws regarding noise and visual quality objectives were identified for the Thompson-Nicola Regional District.
Infrastructure and Services	• The Reroute crosses the existing Spectra Energy pipeline right-of-way twice and the FortisBC right-of-way once. There are seven roads, nine trails, one fibre-optic transmission system cable (crossed five times) and four powerline crossings associated with the Reroute (BC MFLNRORD 2018; BC MFLNRO 2012). • Access to the Coldwater River crossing #1a West Alternative Route DPI location will require the construction of an access bridge across the Coldwater River spanning approximately 80 m. • The remainder of the infrastructure and services setting for the Reroute is consistent with that of the Approved Route.

TABLE 2 Cont'd

Environmental and Socio-economic Elements	Summary of Considerations
Navigation and Navigation Safety	• The Reroute crosses the Coldwater River twice at AK 1.4 and AK 16.7. The Coldwater River is the only river crossed by the Reroute that is considered navigable. • Both crossings of the Coldwater River will use trenchless methods which may employ the use of a guidewire for a short time during installation. A temporary multispan bridge may be required at the Coldwater River crossings #1a.
Employment and Economy	• The economic setting for the Reroute is consistent with that of the Approved Route.
Community Health	• The Reroute does not cross any mapped aquifers (Trans Mountain 2020). • The community health setting for the Reroute is consistent with that of the Approved Route.

3.2 Environmental and Socio-economic Assessment

Pursuant to Section 190 of the *CER Act*, Trans Mountain is applying to vary CPCN OC-065 approving the construction and operation of Line 2 and associated facility details to reflect the Reroute. Guide O of the Filing Manual states that applications to vary a certificate are generally required to reflect changes to previously approved applications, and the applicant must satisfy the filing requirements of the relevant Filing Manual Guide. Therefore, the ESA methodology presented aligns with the requirements outlined in Guide A.2 of the CER Filing Manual (CER 2020).

The description of the environmental setting (current state of the environment) within the Reroute area, is compared against the Project description to assess potential environmental and socio-economic effects that might be caused by the Project. The environmental effects assessment uses the information provided in the environmental setting and Project description to:

- evaluate the environmental elements of importance in the Project area;
- identify and evaluate potential Project effects associated with each environmental element of importance; and
- develop appropriate technically and economically feasible site-specific mitigation and, where warranted, enhancement measures that are technically and economically feasible.

In addition, the environmental and socio-economic effects assessment determines the significance of potential residual effects resulting from construction and operations activities after taking into consideration proposed mitigation measures. Approved mitigation measures outlined in the updated Pipeline Environmental Protection Plan (EPP) (Filing ID C01961).

The assessment evaluates the environmental and socio-economic effects of the construction, operations and future decommissioning and abandonment phases of the Project.

Detailed assessment methodology is provided in Appendix F of this ESA.

An Application seeking to vary an order, certificate, licence or permit must examine the Guide pursuant to the original legal instrument that was issued to determine the applicable filing requirement. As per Guide O of the Filing Manual, the assessment team has reviewed the Reroute in the context of the original ESA and have provided the required information under Guide A to support the proposed change to the Reroute.

A summary of the assessment findings specific to each environmental and socio-economic element, accidents and malfunctions and effects of the environment on the Project for the Reroute is presented in Table 3. Table 3 includes the interactions and potential effects as a result of construction of the Reroute, mitigation and monitoring commitments, updates (if applicable) to the Environmental and Socio-economic Assessment as a result of the Reroute, and the identification of any additional work including field surveys or updates to applicable construction-related documents (*e.g.*, EAS).

Trans Mountain and its Contractors and Subcontractors will implement mitigation measures during construction of the Reroute. The EPP (Filing ID C01961) details the actions required to verify protection of biophysical and socio-economic elements during construction. Trans Mountain's commitments for mitigation and monitoring during and following construction are described in the Pipeline EPP (Filing ID C01961) and the relevant Condition Plans listed for each element in Table 3. Any remaining work associated with the Reroute has been identified per element.

TABLE 3

ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT FOR THE REROUTE

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Physical and Meteorological Environment	• Construction activities (*e.g.*, grading, trenching, backfilling) may create areas of terrain instability. • Removal of vegetation and root mass, grading, cut and fills and runoff controls could lead to localized areas of terrain instability. • During operations, prior to the establishment of a vegetative cover, exposed slopes and cut and fills prone to instability have the potential to become unstable. • Construction activities (*e.g.*, trenched watercourse crossings) may create areas of slope instability. • Topography along the Reroute may be altered at locations where cut slopes are too steep to be returned to the pre-construction profile. • Exposing, excavating or re-using rock during construction can increase the likelihood of ARD.	• Terrain instability due to slumping at watercourse crossings • Terrain instability due to sidehill terrain • Alteration of topography along steep slopes • Alteration of topography along slopes of watercourse crossings • Alteration of topography due to sidehill terrain • Acid generation or metal leaching rock	Yes: • Section 7.2.1 of Volume 5A [Filing ID A3S1Q9] • ESA Update [Filing ID A4F4Z3]	• Pipeline EPP (Filing ID C01961) • Quantitative Geohazard Frequency Assessment (Filing ID A6E8I7) • Field Changes Manual for Geohazard Mitigation (Filing ID CO5736-1) • Risk Management Plan for Geohazards (Filing ID A83579) • Metal Leaching and Acid Rock Drainage Management Plan (Filing ID A84106) • The Reroute corridor allows for the pipeline to be routed below the area of instability. The installation of monitoring tools may be required to monitor potential landslide movement. • If stratigraphic unit, Princeton Group – undivided sediments are, or are expected to be, excavated or disturbed, samples will be collected for testing as soon as possible to determine any additional site-specific practices	Interactions and potential effects on the physical and meteorological environment were assessed in the original ESA (Section 7.0 of Volume 5A of the Facilities Application [Filing ID A3S1Q9]) and related filings. No new or unique interactions between the Reroute and the physical and meteorological environment have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Areas of terrain instability may occur as a result of construction activities. • Alteration of topography may occur at locations where cut slopes are too steep to be replaced to the pre-construction profile without creating areas of terrain instability. • Acidification/contamination of the terrestrial and/or aquatic environment from ARD or metal leaching.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding the physical and meteorological environment remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on the physical and meteorological environment are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction. • Mitigate through use of trenchless construction methods to pass below these hazards and/or with monitoring tools.
Soil and Soil Productivity	• Salvage, storage and replacement of soil during construction and operations can result in topsoil and subsoil mixing. • Trenching during construction can encounter or result in an unstable trench. • During construction, and to a lesser extent, maintenance activities, it is likely that a minor amount of topsoil and subsoil mixing will occur. • Construction activities (*e.g.*, soil salvage, stripping) may unexpectedly encounter lower quality subsoils within localized areas. • Loss of vegetation and soil disturbance will result in changes to evaporation and transpiration rates. • Construction activities may result in localized areas of excessive trench subsidence and/or a remnant crown over the trench. • Construction activities (*e.g.*, transportation of equipment and crews, clearing, grading, clean-up) may introduce or spread soil pests. • Soil compaction as a result of construction activities may result in the reduction of soil pore space and an increase in soil density or mass. • Construction and maintenance activities that disturb the soil will likely result in some surface erosion of topsoil until a stable vegetative cover is established. • Dry conditions during construction may result in the pulverization of soil. • Construction activities may uncover historical contamination.	• Decreased soil productivity due to: – topsoil salvage – trench instability – mixing as a result of shallow topsoil material – mixing as a result of poor colour change – mixing as a result of gravely lower soils – changes in evaporation and transpiration rates – the use of sand as bedding material – release of hydrostatic test water to land – maintenance dig activities during operations – trench subsidence – soil diseases • Soil degradation due to: – compaction and rutting – wind erosion – water erosion – pulverization of soil and sod – release of hydrostatic test water to land • Disposal issues as a result of stone-picking or the removal of bedrock or large rocks from trench depths. • Soil contamination due to: – disturbance of previously contaminated soils – release of hydrostatic test water on land – spot spills during construction	Yes: • Section 7.2.2 of Volume 5A [Filing ID A3S1Q9] • Section 8.2 of Volume 5A [Filing ID A3S1R1] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Agricultural Management Plan (Appendix G of the Pipeline EPP [Filing ID C01961]) • Biosecurity Management Plan (Appendix G of the Pipeline EPP [Filing ID C01961]) • Post-construction environmental monitoring (Condition 151) • Contamination Identification and Assessment Plan (Filing ID A90938)	Interactions and potential effects on soil and soil productivity were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and soil and soil productivity have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Mixing of topsoil and subsoil. • Undesirable lower subsoils may unexpectedly be encountered and admixed with upper subsoil horizon. • Reduction in soil productivity on agricultural areas from changes in evaporation and transpiration rates. • Excessive trench subsidence or remnant crown. • Soil pest introduction and spread. • Degradation of soil structure due to compaction and rutting. • Surface erosion of topsoil can be expected until a vegetative cover is established. • Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions. • Stone-picking and rock removal may result in disposal issues.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding soil and soil productivity remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on soil and soil productivity are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction.

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Water Quality and Quantity	• Two valves are being considered on either side of each of the two proposed Coldwater River trenchless crossings, for a total of four additional valves. The exact locations would be determined during the detailed design stage upon completion of release volume analysis. • The construction of trenched watercourse crossings may increase suspended sediment during instream activities. • Potential flowing artesian conditions may exist at the Coldwater River crossing #2. • An inadvertent release if drilling mud or spot spill may occur during construction or site-specific maintenance during operations. • Pipeline construction activities (*e.g.*, open excavations, hydrostatic testing) may interact with the flow of natural springs or shallow wells or alter the natural streamflow. • The Reroute will be hydrostatically pressure-tested prior to being placed in-service.	• Suspended sediment concentrations in the water column during instream activities • Erosion from approach slopes • Inadvertent instream drilling mud release • Alteration or contamination of aquatic environment as a result of withdrawal and release of hydrostatic test water • Reduction of surface water quality due to small spill during construction or site-specific maintenance activities • Alteration of natural drainage patterns • Disruption or alteration of streamflow • Alteration of streamflow volumes as a result of withdrawal and release of hydrostatic test water • Shallow groundwater with existing contamination encountered during trench construction • Areas susceptible to drilling mud release during trenchless crossing construction • Areas with potential artesian conditions • Areas susceptible to changes in groundwater flow patterns • Disruption of groundwater flow where springs are encountered Areas where dewatering may be necessary during pipeline construction activities • Disruption of groundwater flow where shallow groundwater is encountered • Impacts to shallow wells	Yes: • Section 7.2.3 of Volume 5A [Filing ID A3S1Q9] • Section 8.3 of Volume 5A [Filing ID A3S1R1] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.021 and 3.025 [Filing ID A4H1V2])	• Pipeline EPP (Filing ID C01961) including the Groundwater Management Plan • Post-construction environmental monitoring (Condition 151) • Hydrogeological Study at Coldwater Information Request No. 1 (Filing ID A7F6Y6) • Water Well Inventory (Filing ID A84458) • Watercourse Crossing Inventory (Filing ID C00815) • Consultation reports – protection of municipal water sources (Condition 94)	Interactions and potential effects on surface and groundwater quality and quantity were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and water quality and quantity have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Reduction in surface water quality due to: – suspended sediment during instream activities at trenched crossings – erosion from banks and approach slopes – inadvertent drilling mud release during trenchless crossings of the Coldwater River – contamination from small spills • Localized alteration of natural surface drainage patterns until trench settlement is complete. • Disruption and alteration of natural streamflow from instream activities. • Elevated turbidity in groundwater as a result of accidental drilling mud release or sedimentation. • Groundwater from different aquifers may be mixed. • Flooding from artesian flow may occur during trenchless crossing installation. • Contamination of aquifer as a result of a spill. • Natural groundwater pathways may be bisected and create a sink (drain) for shallow groundwater. • Flooding on the upgradient side of the pipeline may result in creation of wet zones. • Reduction of baseflow to local streams. • Change in natural groundwater levels and stream recharge.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding water quality and quantity remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on water quality and quantity are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction. • The Watercourse Crossing Inventory (Filing ID C00815) will be updated (Appendix B). • The Water Well Inventory (Condition 93) will include the Reroute.
Air Emissions	• The primary source of air and GHG emissions during construction and site-specific maintenance will be from fuel combustion and dust related to the use of transportation vehicles and equipment. • Should the burning of slash be conducted, there will be an increase in nitrogen oxides, carbon monoxide and particulate matter.	• Project contribution to emissions • Dust and smoke during construction	Yes: • Section 7.2.4 of Volume 5A of the Facilities Application (Filing ID A3S1Q9) • Section 8.4 of Volume 5A [Filing ID A3S1R1] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9]	• Pipeline EPP (Filing ID C01961) • GHG Emissions Offset Plan – Project Construction (Condition 142)	Interactions and potential effects on air emissions were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and air emissions have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Increase in air emissions during construction, site-specific maintenance and inspection activities. • Increase in dust and smoke during construction.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding air emissions remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on air emissions are not significant.	N/A

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
GHG Emissions	• The primary sources of GHG emissions will be from construction-related activities including vehicles and heavy-duty equipment use. • Should the burning of slash be conducted, there will be a small increase in GHG emissions. • Direct sources of GHG emissions from the Reroute will be limited to the construction phase and include on-road (*e.g.,* pick-up trucks, semi-trucks) and non-road equipment (*e.g.*, back hoe, dozer, skid steer). • Trans Mountain will incorporate the Reroutet into the existing monitoring program in place for the TMPL system to the extent practical and, consequently, emissions of CO_2e during operations from aerial patrols would not increase relative to existing emissions associated with operations of the greater TMPL system.	• Increase in CO_2e emissions • Changes in environmental parameters (*e.g.,* increase in global temperature)	Yes: • Sections 7.2.4 and 7.2.5 of Volume 5A [Filing ID A3S1Q9] • Section 8.4 of Volume 5A [Filing ID A3S1R1] • ESA Update [Filing ID A4F4Z3] • Responses to Information Request No. 2.019 [Filing ID A3Z4T9] and • Response to Information Request No. 3.018, 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Post-construction GHG assessment report (Condition 140) • GHG Emissions Offset Plan – Project Construction (Condition 142)	Interactions and potential effects on GHG emissions were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and GHG emissions have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Increase in CO_2e emissions. • Changes in environmental parameters (*e.g.*, increase in global temperature).	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding GHG emissions remain unchanged. The predicted Project-related effects of the Reroute on GHG emissions are not significant.	N/A
Acoustic Environment	• Transportation and use of construction equipment and vehicles will increase noise during construction and site-specific maintenance. • The primary proposed crossing methods for the two Coldwater River crossings and side channel is via DPI and HDD. Trenchless crossing activities will run 24-hours a day for approximately 3 to 6 weeks. • Predictive modelling for construction of the TMEP pipeline indicates that an increase in noise levels will be experienced by individual living within 1.5 km of construction. • The nearest receptors to trenchless crossing activities are approximately 359 m from Coldwater River crossing #1a and 207 m from Coldwater River crossing #2. • No blasting is anticipated along the Reroute.	• Changes in sound level during construction.	Yes: • Section 7.2.6 of Volume 5A [Filing ID A3S1Q9] • Section 8.5 of Volume 5A [Filing ID A3S1R1] • ESA Update [Filing ID A4F4Z3] • Terrestrial Noise and Vibration Technical Report in Volume 5C of the Facilities Application (Filing ID A3S1T7) • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2] • Horizontal Directional Drilling Noise Management Plan (Condition 74)	• Pipeline EPP (Filing ID C01961) • Horizontal Directional Drilling Noise Management Plan (Condition 74)	Interactions and potential effects on the acoustic environment were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and the acoustic environment have been identified. The Terrestrial Noise and Vibration Technical Report in Volume 5C of the Facilities Application (Filing ID A3S1T7) found there is potential for high magnitude effects at locations within 300 m of the proposed pipeline corridor due to construction sound emissions; however, noise management plans will be prepared when there are human receptors present within 300 m of construction activities requiring 24 hour operations (*e.g.,* HDD). No new mitigation measures are recommended. The predicted residual effects are: • Increase in sound levels during construction period. • Periodic noise events due to maintenance and inspections. • Increase in airborne/ground-borne vibrations during blasting.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding the acoustic environment remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on the acoustic environment are not significant.	• An HDD Noise Management Plan will be developed for the DPI and HDD crossings of the Coldwater River.
Fish and Fish Habitat	• In general, riparian removal, temporary disturbance to instream habitat, temporary habitat fragmentation, fish salvages and other construction activities all have the potential to cause direct or indirect mortality to fish and fish habitat. • Pipeline construction and maintenance activities may result in instream habitat contamination, loss or alteration of riparian and instream habitat, contamination of instream or riparian habitat from spills and increase the risk of contamination through accidental drilling mud release during construction. • Fish mortality or injury may increase during construction due to an increase in suspended sediment concentration, increased site access, blockage of fish movements and effects on fish species of concern. • Existing vehicle crossings will be used to the extent possible during construction. • The construction of trenched watercourse crossings may increase suspended sediment during instream activities. • The primary proposed crossing method for the two Coldwater River crossings and side channel is via trenchless methods (DPI and HDD). No instream work will be required at the Coldwater River crossing #2, however, pending engineering design studies a multi-span bridge may be required to support installation of the pipe at the Coldwater River crossings #1a.	• Riparian habitat loss or alteration during construction, maintenance and operation • Riparian habitat loss and alteration from accidental drilling mud release • Contamination from spills during construction and maintenance • Instream habitat alteration • Instream habitat alteration from accidental drilling mud release • Contamination from spills during construction • Increased access to instream habitat during operation • Fish mortality or injury during construction or from spot spills • Increased suspended sediment concentrations in the water column during instream construction • Increased suspended sediment concentrations in the water column from accidental drilling mud release	Yes: • Section 7.2.7 of Volume 5A [Filing ID A3S1Q9] • Section 8.6 of Volume 5A [Filing ID A3S1R1] • Section 3.1.2 of the Fisheries (BC) Technical Report 5C-7 in Volume 5C (Filing ID A3S2C1) • Volume 5A of the original ESA – Biophysical Assessment (Filing IDs A3S1L2 to A3S1R3)ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9]	• Pipeline EPP (Filing ID C01961) • Post-construction environmental monitoring (Condition 151) • Watercourse Crossing Inventory (Filing ID C00815) • Riparian Habitat Management Plan (Appendix G of the Pipeline EPP) • Contingency Watercourse Crossings (Filing ID A92907) • Riparian Habitat Reclamation Evaluation Report and Offset Plan (Condition 154) • Fish salvage will be conducted at all trenched fish-bearing watercourse crossings. Water quality monitoring is recommended on high sensitivity crossings with appreciable flow • Where no crossing structures exist, a clear-span bridge, ramp and culvert or other regulatory approved crossing method is recommended	Riparian vegetation removal, temporary disturbance to instream habitat, temporary habitat fragmentation, fish salvages and other construction activities all have the potential to cause direct or indirect mortality to fish. However, the proposed crossing methods, construction timing, mitigation measures and best management practices will minimize the risk of Project-related impacts on fish and fish habitat. Overall, there are no negative impacts to fish or fish habitat (*i.e.,* no harmful alteration, disruption, or destruction [HADD] or death to fish) anticipated. Since no HADD or death of fish are expected with the currently proposed methods, and as there are no known fish species at risk (listed on Schedule 1 of *SARA*), it was determined that Self-Assessments are not necessary at this time. Trans Mountain will consult with CER/Fisheries and Oceans Canada regarding approvals or authorizations and will determine the necessity for additional assessments (*e.g.*, spawning surveys) and the implementation of measures to deter fish from spawning within the immediate zone of influence (ZOI) during construction. Interactions and potential effects on fish and fish habitat, including species at risk and related habitat, were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and fish and fish habitat have been identified. No new mitigation measures are recommended.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding fish and fish habitat, including species at risk and related habitat, remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on fish and fish habitat are not significant.	• If required, supplemental surveys will be completed prior to construction. • The Project EAS and RSMTs will be updated for the Reroute prior to construction. • The Watercourse Crossing Inventory (Filing ID C00815) will be updated (Appendix B). • If required, the appropriate permits and authorizations will be obtained to support the installation of a temporary multispan bridge across the Coldwater River crossing #1a.

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Fish and Fish Habitat (cont'd)	• The proposed crossing method for Salem Creek is an isolated trenched crossing with fish salvage and water quality monitoring if flowing, or an open-cut if dry or frozen to bottom. Although instream work is required at this crossing, no sensitive fish habitat will be disturbed considering the poor habitat conditions (*i.e.*, intermittent flow, high percentage of fine substrates, cattle disturbance and lack of riparian vegetation and instream cover). It is anticipated that the proposed crossing location will be dry during construction (summer/fall). Following the trenched watercourse crossing, Trans Mountain will restore instream and riparian habitat to pre-construction conditions or better. • Potential Reroute interactions with fish and fish habitat for the construction and reclamation phases of the Project are further described in Section 3.1.2 of the Fisheries (BC) Technical Report 5C-7 in Volume 5C (Filing ID A3S2C1).	• Increased access to fish and fish habitat during operations • Blockage of fish movements • Interbasin transfer of aquatic organisms • Contamination, loss, or alteration of instream habitat for indicator species • Mortality or injury for indicator species	(see above)	(see above)	The predicted residual effects are: • Riparian habitat loss or alteration due to construction activities. • Clearing or disturbance of riparian habitat during maintenance and operations. • Alteration of riparian habitat from accidental drilling mud release and associated clean-up activities. • Contamination of riparian habitat from spills during construction and maintenance. • Alteration of instream habitat within the ZOI. • Alteration of instream habitat from drilling mud release. • Contamination of instream habitat from a spill during construction. • Disturbance to instream habitat due to a potential increase in access during operations. • Increased fish mortality or injury due to: – construction activities – spills – suspended sediment during instream construction – suspended sediment from drilling mud release – increase in access during operations • Temporary blockage of fish movement. • Fish species of concern may be affected by an increase in suspended sediment concentration, habitat alteration within the ZOI and increased potential for mortality and injury.	(see above)	(see above)
Wetlands	• Construction activities (*e.g.*, vegetation clearing, grading and topsoil salvage/stripping during Project activities) may disrupt vegetation composition and structure, fragment nesting and foraging habitat for wildlife and alter wetland successional trajectory and type. • Construction activities (*e.g.,* vegetation clearing, topsoil salvage/stripping, grading, trench excavation, backfilling and re-contouring) may reduce water quality and alter the sequestration, storage, cycling and release of carbon and other nutrients. • Construction activities (*e.g.*, vegetation clearing, topsoil salvage/stripping, grading, trench excavation, backfilling and re-contouring) may reduce water quality and alter the sequestration, storage, cycling and release of carbon and other nutrients. • The construction right-of-way will be graded to restore pre-construction contours, where practical and returned to a stable condition. • Possible sources of contamination include spot spills and leaks during construction or site-specific maintenance.	• Loss or alteration of wetlands (*i.e.,* habitat, hydrology, biochemistry) • Contamination of wetland function (*i.e.,* habitat, hydrology, biochemistry)	Yes: • Section 7.2.8 of Volume 5A [Filing ID A3S1Q9] • Section 8.7 of Volume 5A [Filing ID A3S1R2] • ESA Update [Filing ID A4F4Z3] • Responses to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Wetland Survey and Mitigation Plan (Appendix G of the Pipeline EPP) • Rare Ecological Community and Rare Plant Population Management Plan (Condition 40) • Post-construction environmental monitoring (Condition 151) • Wetlands Reclamation Evaluation Report and Offset Plan (Condition 156)	Interactions and potential effects on wetlands were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and wetlands have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Alteration of wetland habitat function during and following construction and maintenance activities until vegetation is re-established. • Alteration of wetland hydrological function during and following construction and maintenance activities until vegetation is re-established. • Alteration of wetland biogeochemical function during and following construction and maintenance activities until sedimentation is controlled and vegetation is re-established. • Reduction of wetland habitat, hydrological and biogeochemical function in the event of a spill during construction.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding wetlands remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on wetlands are not significant.	• If required, supplemental surveys will be completed prior to construction. • The Project EAS and RSMTs will be updated for the Reroute prior to construction.

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Vegetation	• Vegetation (*e.g.*, trees, stumps, brush, grass, crops) will be cleared or mowed from the construction right-of-way and temporary workspace. • Merchantable timber will be salvaged. • On treed lands where erosion is not expected, natural re-vegetation will be the preferred method of reclamation. Non-cultivated agricultural and native grassland areas will be seeded with an appropriate seed mix unless otherwise directed by landowners or Provincial or Local authorities. • Construction activities may contribute to some localized alteration of light levels and natural surface drainage patterns. • The transportation of Project personnel and construction equipment may introduce or spread weeds.	• Loss or alteration of native vegetation • Loss or alteration of the most affected vegetation communities • Loss or alteration of rare ecological communities • Loss or alteration of rare plant and/or lichen occurrences • Weed introduction and spread	Yes: • Section 7.2.9 of Volume 5A [Filing ID A3S1Q9] • Section 8.8 of Volume 5A [Filing ID A3S1R2] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Post-construction environmental monitoring (Condition 151) • Weed and Vegetation Management Plan (Appendix G of the Pipeline EPP) • Rare Ecological Community and Rare Plant Population Management Plan (Appendix G of the Pipeline EPP) • Old Growth Management Areas Mitigation and Replacement Plan (Appendix G of the Pipeline EPP)	All of the nine vegetation species at risk known to occur in the BGC subzones and Forest District of the Reroute were discussed in the 2013 assessment (Filing ID A3S1Q9) except tiny tassle (*Crossidium seriatum*), which was designated as Special Concern by COSEWIC in November 2014 (COSEWIC 2014). The potential impacts to tiny tassle are consistent with those assessed in the discussion of loss or alteration of rare plants and/or lichen occurrences. Interactions and potential effects on vegetation, including species at risk, were assessed in the original ESA and related filings. No new or unique interactions between the Reroute and vegetation have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Alteration of the composition of native vegetation. • Alteration of a variant or ecosite. • Some disturbance or alteration of grassland communities in the Bunchgrass BGC Zone. • Some disturbance or alteration of a rare ecological community, if avoidance is not practical and mitigation measures do not completely protect a site. • If rare ecological communities are located adjacent to the construction right-of-way, they may be indirectly affected by changes in hydrology or light levels. • Some disturbance or alteration of a rare plant or lichen occurrence, if avoidance is not practical and mitigation measures do not completely protect the site. • If rare plant or lichen sub-populations are located adjacent to the construction right-of-way, they may be affected by changes in dust, hydrology, or light levels. • Weed introduction and spread.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding vegetation, including species at risk, remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on vegetation, including species at risk, are not significant.	• If required, supplemental surveys will be completed prior to construction. • Mitigation measures for any rare plants of communities observed during these surveys will be developed according to the Rare Ecological Communities or Rare Plant Species Discovery Contingency Plan and included in the EAS and RSMTs prior to construction. • If required, offsets for rare ecological communities and rare plants will be developed according to the Rare Ecological Community and Rare Plant Population Management Plan (Condition 40). • Summer 2020 field survey results to be included in the Old Growth Management Areas Mitigation and Replacement Plan (Condition 76). • The Project EAS and RSMTs will be updated for the Reroute prior to construction.
Wildlife and Wildlife Habitat	• Pipeline construction activities (*e.g.*, clearing, grading, backfilling) alter wildlife habitat structure. • Pipeline construction and site-specific maintenance activities may create sensory disturbance. • Pipeline construction activities (*e.g.*, stringing, welding, open trench) may present wildlife mortality risks. • Increased traffic due to construction vehicles and equipment travel will contribute to noise and air emissions as well as increase the potential for wildlife mortality.	• Change in habitat • Change in movement • Increased mortality risk	Yes: • Section 7.2.10 of Volume 5A [Filing ID A3S1Q9] • Section 8.9 of Volume 5A [Filing ID A3S1R2] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Mitigation and habitat restoration measures identified in the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan (Filing ID A6C7I3) will be implemented in areas of critical habitat for these species where the biophysical attributes are present, consistent with the approach for areas of critical habitat crossed by the original alignment. • ECCC has advised Trans Mountain that updated critical habitat mapping is not currently available for western screech-owl. Trans Mountain will continue to communicate with ECCC for updated information. • Western Screech-owl Mitigation and Habitat Restoration Plan (Filing ID A6C7J8) • Post-construction Environmental Monitoring (Condition 151) • Pipeline EPP (Filing ID C01961)	The Reroute crosses several WHAs for Williamson's sapsucker that were not previously crossed by the Project. However, the original ESA assessed effects to critical habitat and another WHA for Williamson's sapsucker encountered by the Project. Similar habitat types are encountered on the Reroute and the majority of the WHAs crossed by the Reroute overlap with identified critical habitat for Williamson's sapsucker. The assessment considers WHAs and critical habitat combined as important habitat for Williamson's sapsucker. The potential effects and mitigation and habitat restoration measures that will be implemented within areas of critical habitat for Williamson's sapsucker (per the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan [Filing ID A6C7I3]) where the biophysical attributes of critical habitat are present will also be implemented within the WHAs. No other new or unique interactions between the Reroute and wildlife and wildlife habitat have been identified since they were assessed in the original ESA and related filings. Interactions and potential effects on wildlife and wildlife habitat, including species at risk and related habitat, were assessed in the original ESA and related filings. No new mitigation measures are recommended. The predicted residual effects are: • Combined effects resulting from habitat loss or alteration, changes in movement and increased mortality risk.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding wildlife and wildlife habitat, including species at risk and related habitat, remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on wildlife and wildlife habitat, including species at risk and related habitat, are not significant.	• If required, supplemental surveys will be completed prior to construction. • The Project EAS and RSMTs will be updated for the Reroute prior to construction.

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Species at Risk	• See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.	• See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.	Yes: • Updates under the *SARA* (Filing IDs A84434, A6V8V1) (Condition 92). • See also the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.	• See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.	• See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.	• See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.	• See the Fish and Fish Habitat, Vegetation and Wildlife and Wildlife Habitat entries of this table.
Heritage Resources	• Construction activities may disturb or uncover buried heritage resources.	• Disturbance to previously unidentified archaeological sites, historic sites or palaeontological sites during construction.	Yes: • Section 7.2.1 of Volume 5B [Filing ID A3S1S7]) • ESA Update [Filing ID A4F4Z3]	• Pipeline EPP (Filing ID C01961) • Heritage Resources and Sacred and Cultural Sites Plan (Filing ID A6Y0U2)	Interactions and potential effects on heritage resources were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and heritage resources have been identified. No new mitigation measures are recommended. There are no residual effects identified for the assessment of heritage resources.	N/A - There were no residual effects identified for the assessment of heritage resources.	• An AIA will be completed prior to construction.
Indigenous TLRU	• The construction of the Reroute has the potential to disrupt subsistence hunting, trapping, fishing and plant directly and indirectly through changes to harvesting locales, as well as the broader ecological system, through the temporary physical disturbance of land or resources. • Subsistence activities may also be affected by Project activities resulting from limited access and/or increased public access to traditional harvesting areas and increased pressure on environmental resources. • Project construction activities have the potential to result in a direct loss of or disruption of access to trails, travelways and habitation sites through clearing. Right-of-way clearing may also alter connectivity to trails and travelways and encroach on lands used for cultural activities. Project construction activities increased public access as a result of development that may lead to increased pressure on resource-rich areas and potential or existing habitation sites. • Project construction activities also have the potential to result in a loss of or disturbance to cultural sites and activities. • Noise and activity as a result of construction and operations may also influence the focus and intent of ceremonial activities. • The operations phase of the Project will affect TLRU primarily through temporary disturbances related to site-specific maintenance.	• Disruption of use of trails and travelways • Loss of habitation sites or reduced use of habitation sites • Alteration of plant harvesting sites • Disruption of subsistence activities • Disruption of subsistence fishing activities • Disruption of subsistence trapping activities • Disturbance of gathering places • Disturbance of sacred sites	Yes: • Section 7.2.2 of Volume 5B [Filing ID A3S1S7] • Section 8.2 of Volume 5B [Filing ID A3S1T0] • ESA Update [Filing ID A4F4Z3] • Responses to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Heritage Resources and Sacred and Cultural Sites Plan (Filing ID A6Y0U2) • Reports on Engagement with Indigenous Groups – Construction (Condition 96) • Traditional Land Use Investigation Report (Filing ID A85811) • Plans for Indigenous Group Participation in Construction Monitoring (Filing ID A6V4W9) • Reports on Engagement with Indigenous Groups – Operations (Condition 146)	Interactions and potential effects on Indigenous TLRU was assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and Indigenous TLRU have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Disturbance of trails and travelways. • Sensory disturbance for Indigenous and non-Indigenous local residents and land users. • Change in land use patterns. • Disturbance of habitation sites. • Alteration of subsistence resources. • Disturbance of subsidence activities. • Disturbance of gathering places. • Disturbance of sacred areas.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding Indigenous TLRU remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on Indigenous TLRU are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction.
Social and Cultural Well-Being	• The transportation and use of equipment and vehicles during construction activities will increase traffic and traffic safety issues. • Construction activities will increase the presence of temporary workers in smaller communities. • Construction and site-specific maintenance activities associated with the Reroute may result in effects to community use areas and community way-of-life.	• Change in population and demographics during construction • Change in population during operations • Change in income patterns • Change in community life due to presence of construction activity and temporary workers • Physical disturbance to community assets (*e.g.*, facilities, parks) • Effects on Indigenous harvesting practices and cultural sites • Effects on Indigenous culture due to employment opportunities and other Project activities	Yes: • Section 7.2.3 of Volume 5B [Filing ID A3S1S7] • Section 8.3 of Volume 5B [Filing ID A3S1T0] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Socio-Economic Effects Monitoring Plan (Appendix G of the Pipeline EPP)	Interactions and potential effects on social and cultural well-being use were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and social and cultural well-being have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Change in population and demographics. • Income opportunities associated with Project-related employment. • Changes in income patterns. • Effects on community way-of-life. • Effects on Indigenous culture.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding social and cultural well-being remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on social and cultural well-being are not significant.	N/A

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
HORU	• Construction activities will temporarily increase physical disturbance of land or resources that have a human use. • Construction may cause disturbances to land used traditional use, agriculture use, outdoor recreational use, non-traditional hunting, trapping and fishing. • There may be temporary disturbances to water resources that have a human use (*e.g.*, waterways used for recreational). • Construction may restrict access to certain use areas due the presence of construction traffic and construction activities along roadways. • Construction of the Reroute may have sensory effects due to nuisance noise and air emissions. • Construction activities may present visual effects related to the presence of equipment, workers and worksite lighting. The Reroute does not include the construction or expansion of any aboveground infrastructure. • Operation of the pipeline may create temporary disturbances related to site-specific maintenance.	• Physical disturbance to protected areas • Physical disturbance to facilities including trails and trailheads • Change to access of protected areas • Sensory disturbance of land and resource users • Physical disturbance to Indigenous communities • Physical disturbance to asserted territories • Disruption of TLRU activities • Change to access of asserted traditional territory • Sensory disturbance of land and resource users • Physical disturbance to residential areas • Disturbance to community use areas • Change to agricultural land uses • Disturbance of field, organic or specialty crop areas • Physical disturbance of waterways used for recreational activities • Physical disturbance to outdoor recreational trails and use areas • Disruption of outfitting, trapping, hunting and fishing • Disturbance to OGMAs • Disruption to merchantable timber areas and production • Decline in forest health during construction • Disruption of oil and gas activities • Disruption of mineral and aggregate extraction activities • Change to land access • Alteration of surface water supply and quality for downstream water users • Alteration of well water flow and quality for water users • Alteration of viewsheds	Yes: • Section 7.2.4 of Volume 5B [Filing ID A3S1S7] • Section 8.4 of Volume 5B [Filing ID A3S1T0] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• The Pipeline EPP (Filing ID C01961) • Socio-Economic Effects Monitoring Plan (Appendix G of the Pipeline EPP) • Agriculture Management Plan in Appendix G of the Pipeline EPP • Traffic Management Plan for Public Roadways (Condition 73)	Interactions and potential effects on HORU were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and HORU have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Physical disturbance to natural and built features in protected areas. • Change in land use patterns. • Physical disturbance to asserted traditional territories. • Physical disturbance to residential areas. • Physical disturbance to community use areas. • Effects on livestock or agricultural plants due to the introduction of pests and disease. • Reduced crop yields. • Decrease in quality of the outdoor recreational experience of Indigenous and non-Indigenous resource users. • Disruption of non-traditional non-recreational trapping, hunting and fishing activities of Indigenous and non-Indigenous land users. • Loss of forestry resources and reduction of land base for timber harvest. • Reduction of land base for subsurface activities. • Sensory disturbance for Indigenous and non-Indigenous local residents and land users. • Alteration of viewsheds.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding HORU remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on HORU are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction.

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Infrastructure and Services	• Trans Mountain will utilize existing access roads and trails to the extent possible. Some roads may require up upgrading prior to construction to ensure roads are safe for crew and equipment travel but will be decommissioned after construction with the exception of permanent access roads that will be required for ongoing access to the valve sites. Potential interactions may occur with transportation, linear infrastructure and power supply, waste and water infrastructure, housing, emergency/protective/social services, educational services and recreational amenities.	• Increased traffic due to transportation of workers and supplies • Physical disturbance to roads • Disturbance to railway lines • Effects on linear infrastructure (*e.g.*, subsurface lines, power lines) • Increased demand for power • Increase water infrastructure demand • Increased need for waste management during construction • Demand for housing during construction • Demand for emergency, protective and social services during construction • Use of recreational amenities by workers during construction	Yes: • Section 7.2.5 of Volume 5B [Filing ID A3S1S7] • Section 8.5 of Volume 5B [Filing ID A3S1T0] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 2.041 [Filing ID A3Z4T9] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Access Management Plan (Condition 47) • Traffic Management Plan for Public Roadways (Condition 73) • Worker Accommodation Strategy (Condition 59) • Socio-Economic Effects Monitoring Plan (Appendix G of the Pipeline EPP) • Construction schedule (Condition 62) • Emergency Response Plans for Construction (Condition 89) • Utility Crossings (Filing ID A6X9X0)	Interactions and potential effects on infrastructure and services were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and infrastructure and services have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Increase in traffic on highways and access roads during construction. • Increase in rail volume/traffic. • Sensory disturbance for Indigenous and non-Indigenous local residents and land users. • Physical disturbance to roads during construction due to pipeline road crossings. • Increased need for maintenance on roads due to increased traffic and heavy equipment vehicles. • Upward pressure on power supply/capacity in localized areas. • Temporary increase in water demand during construction. • Temporary increase in solid and liquid waste flows to Regional landfills, transfer station sites and wastewater treatment facilities during construction. • Increased demand and upward pressure for short-term accommodation. • Increased demand on emergency, protective and social services during construction. • Use of recreational amenities by workers during construction.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding infrastructure and services remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on infrastructure and services are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction.
Navigation and Navigation Safety	• A trenchless construction method is recommended for the two crossings of the Coldwater River. • Project activities along the Reroute (such as the installation of a temporary vehicle crossing structure) may disrupt watercourse users at watercourse crossing locations along the Reroute, specifically at the two locations where the pipeline crosses the Coldwater River. While the Coldwater River is not included in Transport Canada's List of Scheduled Waters, it is considered navigable based on its characteristics (*e.g.*, deep wet depth and wide wet depth) that make it suitable for navigational purposes.	• Disruption of watercourse users on navigable watercourses • Concern for safety of watercourse users on navigable watercourses	Yes: • Section 7.2.6 of Volume 5B [Filing ID A3S1S7] • Response to Information Request No. 3.025 [Filing ID A4H1V2] • ESA Update [Filing ID A4F4Z3]	• Pipeline EPP (Filing ID C01961) • Navigation and Navigation Safety Plan (Filing ID A90948)	Interactions and potential effects on navigation and navigation safety were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and navigation and navigation safety have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Impediments to watercourse users on navigable watercourses during construction or site-specific maintenance activities. • The safety of watercourse users on navigable watercourses may be affected in the event the user enters the construction zone.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding navigation and navigation safety remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on navigation and navigation safety are not significant.	• The Project EAS and RSMTs will be updated for the Reroute prior to construction.

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Employment and Economy	Construction activities will generate a demand for goods, services and workers through direct and indirect contracting and procurement opportunities. The Project will result in direct and indirect employment opportunities including supplies and goods and services. Taxes generated as a result of the Project will contribute to government revenues.	• Contracting and procurement opportunities • Training opportunities • Skill and capacity development • Disruption to business or commercial establishments • Disruption to resource-based livelihoods	Yes: • Section 7.2.7 of Volume 5B [Filing ID A3S1S7] • Section 8.6 of Volume 5B [Filing ID A3S1T0] • ESA Update [Filing ID A4F4Z3] • Response to Information Request No. 3.025 [Filing ID A4H1V2]	• Indigenous, Local and Regional skills and business capacity inventory (Condition 11) • Training and Educating Monitoring Plan (Condition 12) • Training and Education Monitoring Reports (Condition 58) • Indigenous, Local and Regional Employment and Business Opportunity Monitoring Reports (Condition 107) • Plans for Indigenous Group Participation in Construction Monitoring (Filing ID A6V4W9)	Interactions and potential effects on employment and economy were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and employment and economy have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Provincial and national economic benefits. • Opportunities for Regional Project-related employment and associated increases in labour income. • Reduced availability of labour for other Regional industries. • Increased Municipal taxes. • Increased personal spending by Project workers and associated increased opportunities for businesses. • Increased Regional contracting and procurement opportunities. • Enhancement of training opportunities for Indigenous groups. • Increased skills due to Project-supported training for Indigenous groups and Project-related employment/contract. • Reduced business or commercial income due to disruption of business. • Reduced resource-based business income or livelihoods.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding employment and economy remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on employment and economy are not significant	N/A
Community Health	• Project-related construction and operations activities have the potential to affect community health directly and indirectly through a number of different mechanisms. The specific components of the Reroute that have been identified as having the potential to directly interact with community health include: – construction activities; – transportation policies and practices; – intentional and unintentional chemical releases; – labour, hiring and contracting policies and practices; – worker housing strategies; – emergency medical response policies and practices; – Indigenous group, Appropriate Government Authorities, landowners, other stakeholders; and – resident/public communication strategies.	• Mental well-being • Alcohol and drug misuse • Demand on and capacity of mental health and addictions services • Increase in rate of STIs • Transmission of infectious respiratory or gastrointestinal disease • Stress and anxiety related to perceived contamination • Traffic-related injury and mortality • Demand on and capacity of hospitals and health care facilities • Demand on and capacity of emergency medical response • Effects on diet and nutritional outcomes	Yes: • Sections 7.2.8 of Volume 5B [Filing ID A3S1S7] • Section 8.7 of Volume 5B [Filing ID A3S1T0] • ESA Update [Filing ID A4F4Z3] • Responses to CER Information Request No. 2.041 [Filing ID A3Z4T9] and CER Information Request No. 3.025 [Filing ID A4H1V2]	• Pipeline EPP (Filing ID C01961) • Hydrogeological Study at Coldwater IR No. 1 (Condition 39) • Socio-Economic Effects Monitoring Plan (Appendix G of the Pipeline EPP) • Worker Accommodation strategy (Filing ID A84812)	Interactions and potential effects on community health were assessed in the original ESA (Section 7.0 of Volume 5B of the Facilities Application [Filing ID A3S1S9]) and related filings. No new or unique interactions between the Reroute and community health have been identified. No new mitigation measures are recommended. The predicted residual effects are: • Effects on – Mental well-being – Alcohol and drug misuse – Increased demand on mental health and addictions services – Diet and nutritional outcomes – Increase in number of STIs – Increase in number of respiratory or gastrointestinal illness • Increase in stress and anxiety related to perceived contamination • Increased traffic-related injury and mortality • Increase demand on: – hospitals and health care facilities – increased demand on emergency medical response	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding community health remain unchanged. The predicted Project-related effects of the Reroute and cumulative effects on community health are not significant.	N/A

TABLE 3 Cont'd

Element	Interaction(s)	Potential Effect(s)	Previously Considered in Original ESA and Associated Filings	Mitigation or Monitoring Commitment	Residual Effects	Effects and Cumulative Effects Assessment Conclusion	Additional Work
Accidents and Malfunctions	• Accidents and malfunctions are unplanned events that could result in significant adverse effects to human health, property or the environment, but are unlikely to occur. While accidents and malfunctions are predicted to be unlikely for the Project, the potential consequences are evaluated so that emergency response and contingency planning can be identified to verify the risk is further mitigated.	• Project activities may result in an accident or malfunction, including: – Spill of hazardous materials during construction and maintenance activities – Fire during construction and operations – Damage to foreign utilities during construction and operations – Transportation accidents – Use of explosives – Security risk	Yes: • Section 7.9 of Volumes 5A and 5B [Filing IDs A3S1R0 and A3S1S9] • Recommendation Report (Filing ID A77045)	• Pipeline EPP (Filing ID C01961) • Security Management Plan (Condition 63) • Emergency Response Plans for Construction (Condition 89) • Consultation on Improvements to Trans Mountain's Emergency Management Program (Condition 90) • Reporting on Improvements to Tran Mountain's Emergency Management Program (Condition 117) • Emergency Preparedness and Response Exercise and Training Program (Condition 119) • Notification and Reporting on Emergency Response Exercises (Condition 120) • Implementing Improvements to Trans Mountain's Emergency Management Program (Condition 124) • Emergency Response Plans for the Pipeline (Condition 125) • Pre-operations Full-scale Emergency Response Exercises (Condition 136) • Full-scale Emergency Response Exercise During Operations (Condition 153)	The activities that may cause an accident or malfunction during construction or operation are the same as those considered in the original ESA and related filings. The receiving environment that may be affected in the event of an accident or malfunction is the same as that considered in the original ESA. The predicted residual effects are: • Contamination or alteration of surface or groundwater during construction which may affect human health. • Despite vigilance, fires may adversely affect adjacent property. • Damage to utility lines could lead to interruption of services and fires in the case of gas. • A transportation accident may cause injury to people or may result in a fire depending on the location and severity of the accident. • Injury from fly rock or unintentional detonation of explosives. • Damage from criminal activity.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding accidents and malfunctions remain unchanged.	N/A
Effects of the Environment on the Project	• Severe weather (including high wind speeds, heavy precipitation, wildfire or extreme temperatures, lightning and temperature inversions) may delay the Project schedule. • Geohazards pose potential threats to pipeline projects during construction with respect to worker safety, and during operations with respect to potential damage to infrastructure and the safety of operating personnel.	• Hydrotechnical hazards (*i.e.*, flooding, scour, bank erosion, debris flood, debris flow and avulsion) • Geotechnical hazards (*i.e.*, rock slope hazards and soil slope hazards) • Seismic hazards (*i.e.*, liquefaction, fault displacement, strong shaking and historic faults) • Wildfires • Changing climate •	Yes: • Section 7.10 of Volumes 5A and 5B [Filing IDs A3S1R0 and A3S1S9] • Risk Assessment and Management of Pipeline and Facility Spills Sections 6.0, 7.0 and 8.0 Technical Reports (Volume 7).	• Pipeline EPP (Filing ID C01961) • Natural Hazard Assessment (Condition 147)	Interactions and potential effects of the environment on the Project were assessed in the original ESA and related filings. No new or unique interactions have been identified. No new mitigation measures are recommended. The Reroute does not encounter any new environmental features or include new Project components that have not otherwise been considered in the original ESA and related filings.	The Project assessment team has reviewed the information gathered on the Reroute and determined that the significance conclusions of the ESA regarding effects of the environment on the Project remain unchanged.	N/A

4.0 SUMMARY

The approximately 18.4 km long Reroute deviates from the Approved Route at KP 931.36, re-joining at KP 946.88 (Figure 1). The Reroute was not included in the approved pipeline corridor; therefore, an Application for Variance under Section 190 of the *CER Act* is required to vary the CPCN to reflect changes to the previously approved Application. The assessment team reviewed the proposed variance and determined that interactions, potential effects, mitigation measures, and residual and cumulative effects related to the Reroute are similar to those identified during the original ESA (Volumes 5A and 5B of the Facilities Application) (Filing ID A56004) and related filings (Table 3).

The Reroute encounters four new environmental features that were not encountered by the Approved Route; however, these are identified and addressed in the original respective element-specific assessment.

1. The Reroute encounters lands considered to have a medium risk for natural hazard potential. Terrain stability and natural hazard (*e.g.,* rock fall, debris flow, debris floods, floods, channel changes, rock avalanches) mapping completed for the Reroute identified glaciofluvial, fluvial, till, colluvial, glaciolacustrine, anthropogenic and organic surface materials and bedrock (BGC 2020). This risk can be mitigated through use of trenchless construction methods to pass below these hazards and/or with monitoring tools.
2. The Reroute crosses the Coldwater River in two locations. Trans Mountain is proposing two trenchless crossings of the Coldwater River. The first crossing will use DPI with a contingency of micro-tunnelling. The second crossing of the Coldwater River will be an HDD, with a contingency to use DPI. No instream work will be required at the Coldwater River crossing #2, however, pending engineering design studies a temporary multi-span bridge may be required to support installation of the pipe at the Coldwater River crossing #1a. If a temporary multi-span bridge is required, the appropriate permits and authorizations will be obtained. The installation of a temporary vehicle crossing structure may disrupt watercourse users at the Coldwater River crossing #1a. While the Coldwater River is not included in Transport Canada's List of Scheduled Waters, it is considered navigable based on its characteristics (*e.g.*, deep wet depth and wide wet depth) that make it suitable for navigational purposes.
3. The Reroute crosses several WHAs for Williamson's sapsucker that were not previously crossed by the Project. Most of the length of these WHAs overlaps with critical habitat for Williamson's sapsucker as identified by ECCC. The mitigation and habitat restoration measures that will be implemented within areas of critical habitat for Williamson's sapsucker (per the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan [Filing ID A6C7I3]) will also be implemented within the WHAs, where the biophysical attributes of critical habitat are present. The mitigation and habitat restoration measures identified in the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan (Filing ID A6C7I3) will be implemented in areas of critical habitat for Williamson's sapsucker where the biophysical attributes are present, consistent with the approach for areas of critical habitat crossed by the original alignment. Similarly, if critical habitat mapping for western screech-owl is received from ECCC and overlaps with the Reroute, mitigation and habitat restoration measures will be implemented per the Western Screech-owl Mitigation and Habitat Restoration Plan (Filing ID A6C7J8). Field studies to identify site-specific locations of biophysical attributes (*e.g.*, suitable nest trees and colonies of aphid tending ants) and species-specific surveys for Williamson's sapsucker were completed along the Reroute during the appropriate survey period in June 2020 to inform mitigation.
4. The Reroute centreline is approximately 77 m from a water supply well. The Groundwater Management Plan in the EPP outlines measures to protect and monitor groundwater during construction. Water well (Tag #115219) is licenced under the BC *Water Sustainability Act* to divert groundwater for livestock watering use.

The original ESA (Filing ID A56004) and related filings (Table 3) concluded that with implementation of the mitigation presented in the Application, the predicted residual and cumulative effects of Project construction and operation are not significant for all of the terrestrial biophysical and socio-economic indicators assessed. There are no new or unique interactions with the environmental and socio-economic elements identified as a result of the Reroute.

Supplemental surveys and updates to applicable construction-related documents (*e.g.*, EAS and RSMTs) will be completed prior to construction to include the specific mitigation and monitoring measures relevant to the Reroute (Table 3).

The assessment team reviewed the Reroute and determined that it will not change the effects assessment criteria or significance conclusions of the original ESA and related filings. The assessment concludes that with the appropriate mitigation, the predicted Project-related effects and cumulative effects of the proposed variance are not significant.

5.0 REFERENCES

5.1 Personal Communications

Donavan, M. British Columbia Conservation Data Centre. 2020. Personal communication (email) with Tyler Innes, Jacobs. July.

5.2 Literature Cited

Agricultural Land Commission (ALC). 2020. *ALC ALR Polygons* (digital file). Victoria, BC. Acquired June 16, 2020. https://catalogue.data.gov.bc.ca/dataset/alc-alr-polygons.

BGC Engineering Inc. (BGC). 2020. Trans Mountain Pipeline ULC. Trans Mountain Expansion Project. *Geohazard Study for West Alternate Route Around Coldwater IR*. 22 pp.

Bird Studies Canada. 2015. *Important Bird Areas of Canada Database*. Port Rowan, Ontario: Bird Studies Canada. Accessed December 2019. http://www.ibacanada.org.

British Columbia Ministry of Environment (BC MOE). 2010. *Caribou Distribution in British Columbia by Ecotype*. Accessed December 2019. http://www.env.gov.bc.ca/wld/speciesconservation/caribou_by_ecotype.html.

British Columbia Ministry of Environment (BC MOE). 2012. *Grizzly Bear Population Units* (digital file). Victoria, British Columbia. Accessed December 2019. https://catalogue.data.gov.bc.ca/dataset/grizzly-bear-population-units.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2019a. *Environmental Remediation Sites* (digital file). Accessed August 2020. https://catalogue.data.gov.bc.ca/dataset/environmental-remediation-sites.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2019b. *Ground Water Wells* (digital file). Victoria, BC. Acquired May 13, 2019. https://catalogue.data.gov.bc.ca/dataset/ground-water-wells.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2019c. *Traplines of British Columbia* (digital file). Victoria, BC. Acquired November 19, 2019. https://catalogue.data.gov.bc.ca/dataset/traplines-of-british-columbia.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2020. *Wildlife Habitat Areas - Approved* (digital file). Victoria, BC. Acquired June 16, 2020. https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-approved.

British Columbia Ministry of Forests (BC MOF). 1998a. *The Ecology of the Ponderosa Pine Zone.* Victoria, BC. Accessed July 2020. http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro60.pdf.

British Columbia Ministry of Forests (BC MOF). 1998b. *The Ecology of the Bunchgrass Zone*. Victoria, BC. Accessed July 2020. http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro54.pdf.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO). 2008a. *Recreation Lines* (digital file). Victoria, BC. Acquired July 3, 2018. https://catalogue.data.gov.bc.ca/dataset/recreation-line.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO). 2008b. *Recreation Polygons* (digital file). Victoria, BC. Acquired August 30, 2017. https://catalogue.data.gov.bc.ca/dataset/recreation-polygons.

British Columbia Ministry of Forests, Lands and Natural Resource Operations (BC MFLNRO). 2012. *Digital Road Atlas (DRA) - Master Partially Attributed Road Data* (digital file). Victoria, BC. Acquired December 15, 2015. https://catalogue.data.gov.bc.ca/dataset/digital-road-atlas-dra-master-partially-attributed-roads.

British Columbia Ministry of Forests, Lands, Natural Resources Operations, and Rural Development (BC MFLNRORD). 2018. *Biogeoclimatic Ecosystem Classification Mapping* (Ver 11, Aug 10, 2018) (digital file). Acquired January 20, 2020. https://catalogue.data.gov.bc.ca/dataset/bec-map.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2019a. *Ungulate Winter Range – Proposed.* Accessed December 2019. https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-proposed.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2019b. *Wildlife Habitat Areas – Proposed.* Accessed December 2019. https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-proposed.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2019c. *CDC Species, Masked Secured* (digital file). Acquired November 25, 2019. https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-masked-secured-publicly-available-occurrences-cdc

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2019d. *Forest Tenure Managed License* (digital file). Victoria, BC. Acquired November 20, 2019. https://catalogue.data.gov.bc.ca/dataset/forest-tenure-managed-licence.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2020a. *Old Growth Management Areas, Non-Legal* (digital file). Victoria, BC. Acquired June 16, 2020. https://catalogue.data.gov.bc.ca/dataset/old-growth-management-areas-non-legal-current.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2020b. *Ungulate Winter Range, Approved* (digital file). Acquired June 16, 2020. https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-approved.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2020c. *Water Rights Licenses – Public.* Victoria, BC. Acquired January 15, 2020. https://catalogue.data.gov.bc.ca/dataset/water-rights-licences-public.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2020d. *CDC Species, Non-Sensitive* (digital file). Acquired March 25, 2020 https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-publicly-available-occurrences-cdc.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2020e. *TANTALIS - Crown Tenures.* Victoria, BC. Acquired January 15, 2020. https://catalogue.data.gov.bc.ca/dataset/tantalis-crown-tenures.

British Columbia Oil and Gas Commission (BC OGC). 2018. *British Columbia Noise Control Best Practices Guideline*. Accessed October 2019. https://www.bcogc.ca/node/11095/download.

British Columbia Parks (BC Parks). 2019. *BC Parks Map*. Accessed December 2019. http://www.env.gov.bc.ca/bcparks/explore/regions.html.

Bureau of the Convention on Wetlands. 2016. *The Ramsar List: The List of Wetlands of International Importance*. Gland, Switzerland. 47 pp.

Canada Energy Regulator (CER). 2020. *Filing Manual*. Inclusive of Release 2020-02 (August 2020). Calgary, Alberta. http://www.cer-rec.gc.ca/bts/ctrg/gnnb/flngmnl/fmgda2-eng.html#sa_2_1.

Coldwater Indian Band (CIB). 2020. *Economic Development Opportunities*. Accessed January 2020. https://www.coldwaterband.com/governance/opportunities

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2014. *COSEWIC Assessment and Status Report on the Tiny Tassel Crossidium seriatum in Canada*. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Ix +33pp.

Demarchi, D.A. 2011. *The British Columbia Ecoregion Classification*. Third Edition, March 2011. Ecosystem Information Section, Ministry of Environment. Victoria, BC. Accessed February 2020. https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/ecosystems/broad-ecosystem/an_introduction_to_the_ecoregions_of_british_columbia.pdf.

Dynamic Risk Assessment Systems Inc. (Dynamic Risk). 2015. *Updated Preliminary Risk Results for TMEP Coldwater IT #1 Alignment Comparison.* Prepared for Trans Mountain Pipelines Inc. 19 pp.

Environment Canada. 2014. *Recovery Strategy for the Woodland Caribou, Southern Mountain Population (Rangifer tarandus caribou) in Canada*. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa, ON. viii + 68 pp.

Environment and Climate Change Canada (ECCC). 2016. *Amended Recovery Strategy for the Williamson's Sapsucker (Sphyrapicus thyroideus) in Canada*. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vi + 32 pp.

Environment and Climate Change Canada (ECCC). 2017. *Migratory Bird Sanctuaries.* Accessed December 2019. https://www.canada.ca/en/environment-climate-change/services/migratory-bird-sanctuaries/locations.html.

Environment and Climate Change Canada (ECCC). 2019a. *Canadian Climate Normals 1981-2010 Station Data for Merritt STP, British Columbia.* Accessed May 2020. https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=merritt&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=1022&dispBack=1.

Environment and Climate Change Canada (ECCC). 2019b. *Critical Habitat for Species at Risk, British Columbia* (digital file, detailed polygons). Ottawa, On. Current to February 20, 2019. http://donnees.ec.gc.ca/data/species/developplans/critical-habitat-for-species-at-risk-british-columbia/.

Environment and Climate Change Canada (ECCC). 2019c. *National Wildlife Areas.* Accessed December 2019. https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/locations.html.

Environment and Climate Change Canada (ECCC). 2019d. *Critical Habitat for Williamson's Sapsucker* (digital file, detailed polygons). Current to February 20, 2019. Downloaded from http://donnees.ec.gc.ca/data/species/developplans/critical-habitat-for-species-at-risk-british-columbia/.

Government of Canada. 2019a. *Trans Mountain Expansion Project (TMEP) – Crown Consultation and Accommodation Report (June 2019) [CCAR]*. Accessed May 2020. https://www.canada.ca/content/dam/nrcan-rncan/site/tmx/TMX-CCAR_June2019-e-accessible.pdf.

Government of Canada. 2019b. *Aboriginal Lands, Canada* (digital file). Edmonton, AB. Acquired December 6, 2019. http://open.canada.ca/data/en/dataset/522b07b9-78e2-4819-b736-ad9208eb1067.

Holland, S.S. 1976. *Landforms of British Columbia: A Physiographic Outline.* Bulletin 48, The Government of the Province of British Columbia. 138 pp.

Jacobs Consultancy Canada Inc. (Jacobs). 2020a. *Residences / Receptors* (digital file). Calgary, AB. Digitized from Image Interpretation. Imagery Source: Imagery Source: Esri (Maxar), image date 10/16/2018. Image Resolution 0.5m. Image accuracy 8.47m.

Jacobs Consultancy Canada Inc. (Jacobs). 2020b. *Parallel Disturbance* (digital file). Calgary, AB. Digitized from Province of BC Crown Tenure, Digital Road Atlas and Image Interpretation. Imagery Source: Esri (Maxar), image date 10/16/2018. Image Resolution 0.5m. Image accuracy 8.47m.

Journeay, J.M., S.P. Williams and J.O. Wheeler. 2000. *Tectonic Assemblages Map, Vancouver, British Columbia.*

LGL Limited Environmental Research Associates (LGL). 2007. *Development of an Annual Salmonid Productivity Assessment Program for the Nicola River Watershed*. M. Mathews, B. Bocking, G. Glova, N. Todd and T. Sampson. Prepared for the Pacific Salmon Foundation. Accessed January 2013. https://www.psf.ca/sites/default/files/FSWP_07_D2_NTA_FINAL_REPORT.pdf.

Lloyd, D., K. Angove, G. Hope and C. Thompson. 1990. *A Guide to Site Identification and Interpretation for the Kamloops Forest Region*. Land Management Handbook no. 23. British Columbia Ministry of Forests. Victoria, BC.

Kinder Morgan. 2012. *Trans Mountain Pipeline (TMPL)* (digital file). Calgary, AB.

Millar, J.M. Child and N Page. 1997. *Nicola River Watershed: Fisheries Resources Issues and the Involvement of DFO, MELP and First Nations*. Department of Fisheries and Oceans, Fraser River Action Plan.

Natural Resources Canada (NRCan). 2010. P*otential Impacts: Wind Erosion Risk and Climate Sensitivity.* Accessed January 2020. https://open.canada.ca/data/en/dataset/df3aaf11-8893-11e0-aaa0-6cf049291510.

Opus Stewart Weir. 2020. *Parcel Mapping for Trans Mountain Expansion Project* (digital file). Calgary, AB. Received via FTP: June 1, 2020. Last Updated Check: N/A.

Thompson-Nicola Invasive Plant Management Committee (TNIPMC). 2020. *Regional Invasive Plants.* Accessed January 2020. http://tnipmc.com/index.php/our-invasive-plants/regional-invasive-plants/.

Thompson-Nicola Regional District (TNRD). 2011. *Nicola Valley Official Community Plan*. Revised October 27, 2011. Accessed November 2019. https://tnrd.civicweb.net/document/61130/Nicola%20Vally%20Official%20Community%20Paln%20(October%202011).pdf.

Thompson-Nicola Regional District (TNRD). 2015. *Bylaw Enforcement*. Accessed January 2020. https://www.tnrd.ca/content/bylaw-enforcement-0.

Tourism Merritt. 2019. *Tourism Merritt*. Accessed November 2019. https://www.tourismmerritt.ca.

Trans Mountain Pipeline ULC (Trans Mountain). 2020. *Detailed Route Hearing Order MH-004-2020: West Alternative Feasibility Study.* Accessed June 2020. https://docs2.cer-rec.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/548311/956726/2392873/3781699/3913816/C05744-1_West_Alternative_Feasibility_Study_DRH_Order_MH-004-2020_April_15%2C_2020_-_A7E8W7.pdf?nodeid=3913820&vernum=-2.

Western Hemisphere Shorebird Reserve Network (WHSRN). 2019. *Sites in the Western Hemisphere Shorebird Reserve Network.* Accessed December 2019. https://whsrn.org/whsrn-sites/.

5.3 GIS References

BC Ministry of Citizens Services. 2020. ParcelMap BC Parcel Fabric (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/parcelmap-bc-parcel-fabric. Acquired: July 22, 2020.

BC Forests, Lands and Natural Resource Operations. 2008. BC Freshwater Atlas Stream Network (digital file). Victoria, BC. Available: https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-stream-network. Acquired: July 2011. Last Update Check: January 20, 2014.

IHS Inc. 2020. IHS Enhanced Pipeline Data (digital file). Calgary, AB. Received: via FTP at https://ftga.ihs.com/webclient/WebClient.jsf, visit http://www.ihs.comfor more info. Acquired: March 6, 2020.

Jacobs. 2020. Wetlands (digital file). Calgary, AB. Professionally assessed wetlands current to July 8, 2020

Trans Mountain Pipeline ULC. 2020. Proposed Coldwater Reroute (AR3359) Access Corridors (digital file - 200520_CW IR_Access Roads). Calgary AB. Received via email: June 29, 2020. Last Updated Check: N/A.

Trans Mountain Pipeline ULC. 2020. Proposed Coldwater Reroute (AR3359) Centreline, Footprint and AK Markers (digital file – 19731-511-DAT-0863-RB). Calgary AB. Received via email: May 26, 2020. Last Updated Check: N/A.

APPENDIX A

VEGETATION TECHNICAL DATA REPORT

VEGETATION TECHNICAL DATA REPORT FOR THE COLDWATER WEST ALTERNATIVE REROUTE FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

September 2020
FINAL
01-13283-S5A-M002-EV-RPT-0008

Prepared for:

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

Jacobs Consultancy Canada Inc.
205 Quarry Park Blvd SE
Calgary, Alberta T2C 3E7
Ph. 403-407-8700

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
AK	Alternative Kilometre Post
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC ENV	British Columbia Ministry of Environment and Climate Change Strategy
BC MFLNRORD	British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BC OGC	British Columbia Oil and Gas Commission
BGC	biogeoclimatic
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
Coldwater IR	Coldwater Indian Reserve No. 1
Coldwater Reroute ESA	Environmental and Socio-Economic Assessment for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPCN	Certificate of Public Convenience and Necessity
DPI	Direct Pipe® Installation
EAS	Environmental Alignment Sheet
EPP	Environmental Protection Plan
ESA	Environmental and Socio-Economic Assessment
FRPA	*Forest and Range Practices Act*
ha	hectare(s)
HDD	horizontal directional drill
IDF	Interior Douglas-fir
km	kilometre(s)
KP	Kilometre Post
LSA	Local Study Area
m	metre(s)
NEB	National Energy Board
OGMA	Old Growth Management Area
PP	Ponderosa Pine
RSA	Regional Study Area
RSMT	Resource-Specific Mitigation Table
SARA	*Species at Risk Act*
the Application	Facilities Application under Section 52 of the *National Energy Board*
the Approved Route	the route previously-approved by the Canada Energy Regulator - Project corridor that passed to the east of Coldwater Indian Reserve No. 1
the Project or TMEP	Trans Mountain Expansion Project
the Reroute	approximately 18.4 km Reroute of the Project
the West Alternative Route	a western route option that avoided the Coldwater Indian Reserve No. 1
TNIPMC	Thompson-Nicola Invasive Plant Management Committee
Trans Mountain	Trans Mountain Pipeline ULC
UTM	Universal Transverse Mercator
VRI	Vegetation Resources Inventory

TABLE OF CONTENTS

Page

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) submitted a Facilities Application under Section 52 of the *National Energy Board Act* (the Application) to the Canada Energy Regulator (CER) (formerly the National Energy Board [NEB]) in December 2013 for the Trans Mountain Expansion Project (the Project or TMEP). A Certificate of Public Convenience and Necessity (CPCN) was issued by the CER on June 21, 2019.

Trans Mountain is proposing an approximately 18.4 km reroute (the Reroute) from the current Project routing in proximity to the Coldwater Indian Band Indian Reserve No. 1 (Coldwater IR) in British Columbia (BC). A western route option that avoided the Coldwater IR (the West Alternative Route) was considered during early Project planning, however was ultimately not selected as a preferred route (refer to Section 4.2 of the original Environmental and Socio-Economic Assessment [ESA] [Filing ID A3S1L4]).

Coldwater Indian Band has suggested that a refined West Alternative Route be considered, and Trans Mountain committed to conducting a feasibility study in response to concerns raised by Coldwater Indian Band regarding the route previously approved by the CER (the Approved Route). The approximately 18.4 km long Reroute deviates from the Approved Route at KP 931.36, re-joining at KP 946.88 (Figure 1). The Reroute was not included in the approved pipeline corridor; therefore, an Application for Variance under Section 190 of the *Canadian Energy Regulator Act* (*CER Act*) is required to vary the CPCN to reflect changes to the previously-approved Application.

Trans Mountain is proposing two trenchless crossings of the Coldwater River – one at the north end and one at the south end of the Reroute. In the Western Feasibility Study, filed in April 2020, Trans Mountain put forward plans to use a horizontal directional drill (HDD) crossing method for both crossings. Since that time, and with the benefit of additional geotechnical drilling results, Trans Mountain has decided to implement alternate trenchless construction methods for the northern crossing due to challenging geotechnical conditions in that area. These alternative and preferred methods are by Direct Pipe® Installation (DPI) and, as a contingency should the DPI prove infeasible, micro-tunnelling. Trans Mountain's primary considerations are to install the crossing in a manner that avoids disturbance to the Coldwater River, while also reducing the technical risks of the crossing based on the geotechnical conditions.

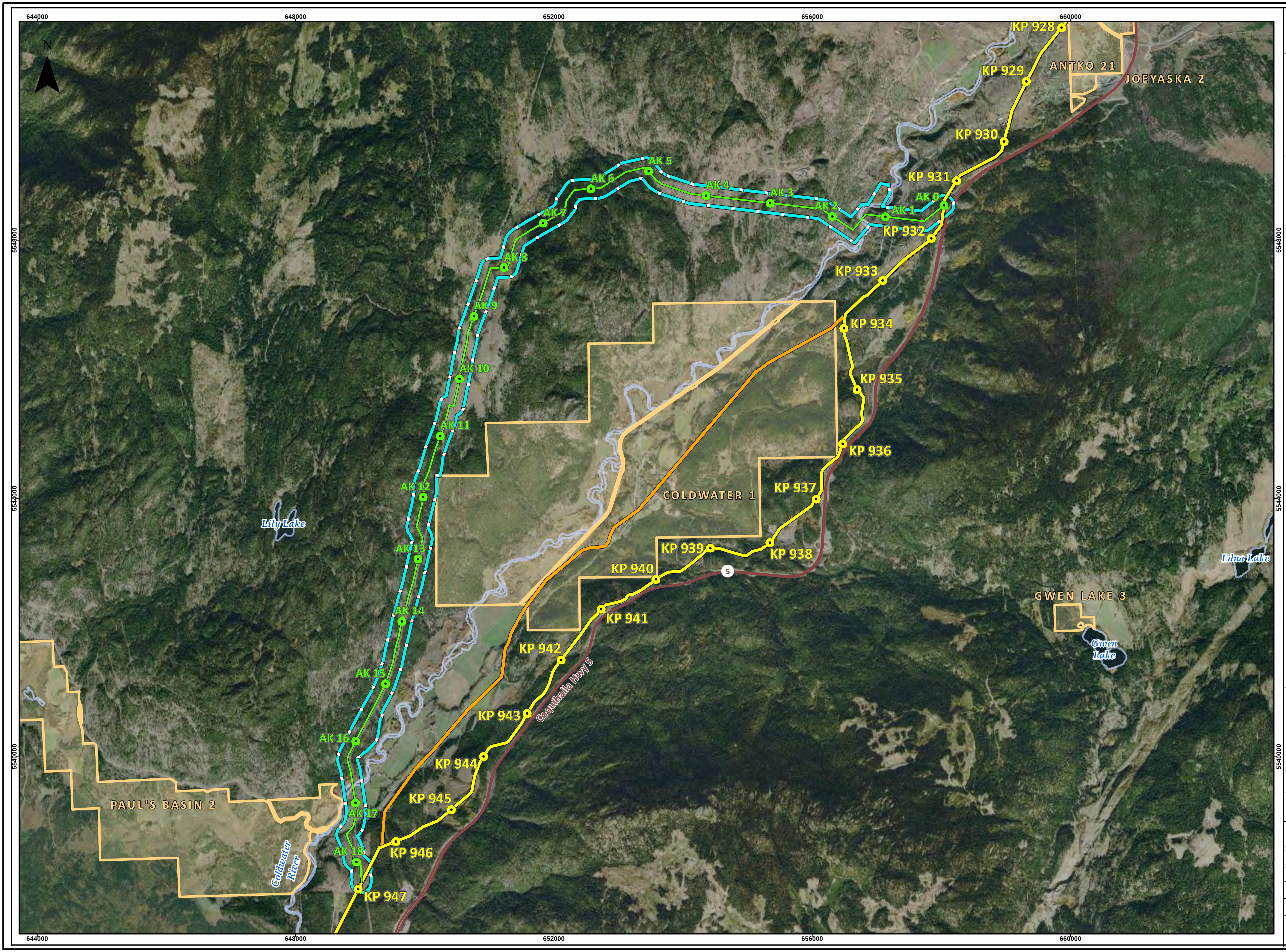
The objectives of the vegetation survey completed for the Reroute were to:

- Provide guidance on the Federal and Provincial regulatory context that applies to the disturbance of vegetation by Reroute activities.
- Characterize vegetation communities in the Reroute study area via desktop review to support the understanding of existing environmental conditions and the assessment of potential effects in the ESA.
- Identify vegetation species and communities listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the *Species at Risk Act* (*SARA*), *Forest and Range Practices Act* (*FRPA)* and the BC Conservation Data Centre (BC CDC) Red and Blue lists encountered by the Reroute to support regulatory requirements related to vegetation.
- Identify Invasive Plant species in the Reroute study area.
- Collect vegetation field data to obtain baseline information on vegetation, support regulatory requirements related to vegetation and facilitate post-construction monitoring of vegetation.

The information collected from desktop review, field reconnaissance conducted in October 2019, early season rare plant survey in June 2020 and late season rare plant survey in July 2020 was used to inform the assessment of potential adverse effects for vegetation, and to support the implementation of technically and economically feasible mitigation to reduce potential effects on vegetation. The potential residual and cumulative effects of the Reroute on vegetation function, including an evaluation of significance, are presented in Section 7.2.8 of Volume 5A (Filing ID A3S1Q9), Section 8.7 of Volume 5A (Filing ID A3S1R2), an ESA Update (Filing ID A4F4Z3), Responses to Information Request No. 2.041 (Filing ID A3Z4T9), Response to Information Request No. 3.025 (Filing ID A4H1V2).

Mitigation measures related to rare plants, rare ecological communities and invasive species of concern are provided in the Project-specific Environmental Protection Plan (EPP) (Filing ID C01961).

Environmental Resource Maps are provided in Appendix G of the Environmental and Socio-Economic Assessment for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project (Coldwater Reroute ESA) clearly depicting the Reroute and summarizing the pertinent environmental information gathered during field surveys completed to date and desktop research. If the Variance Application is approved, Environmental Alignment Sheets (EAS) and Resource-Specific Mitigation Tables (RSMTs) will be provided to the CER prior to construction.



TRANS MOUNTAIN

FIGURE 1

OVERVIEW OF THE COLDWATER WEST ALTERNATIVE REROUTE

PROPOSED TRANS MOUNTAIN PIPELINE ULC

● Coldwater Reroute Kilometre Post (AK)

● TMEP Pipeline Kilometre Post (KP)

━ Coldwater Reroute

━ TMEP Pipeline

━ Existing TMPL Pipeline

━①━ Highway

▭ Coldwater Reroute 300m Corridor

▭ Indian Reserve

▭ Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 8, 2020; Transportation: BC MFLNRO 2012; Hydrology: BC MFLNRO 2008; First Nation Lands: Government of Canada 2018; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202008_MAP_CH2M_GEN_01194_REV2_FIG1

DATE	REFERENCE	REVISION
September 2020	CE771600	2
SCALE	PAGE SIZE	DISCIPLINE
1:55,000	11x17	GEN
DRAWN	CHECKED	DESIGN
SAB	DJN	CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01194_Rev2_Fig1.mxd

2.0 REGULATORY CONTEXT

Regulatory guidance on Federal and Provincial standards, legislation and approvals applicable to the interaction of Reroute activities with vegetation is provided as follows.

2.1 Federal Standards

2.1.1 Species at Risk Act

SARA protects species listed as Extirpated, Endangered and Threatened on Schedule 1 of the *Act*. Species included on Schedule 1 are established by the Federal Cabinet and are based on recommendations by COSEWIC and consultation with government, Indigenous groups and the public. *SARA* applies to Federal lands; however, it may also apply to other lands when Provincial protection is deemed inadequate by the Federal Minister of the Environment. Prohibitions included in *SARA* make it an offence to kill, harm, harass, capture or take an individual of a vegetation species listed as Endangered, Threatened or Extirpated on Schedule 1. The prohibitions also make it an offence to possess, collect, buy, sell, or trade an individual, or damage/destroy the residence of one or more individuals of a species listed on Schedule 1.

Measures to protect and recover a listed species are to be outlined in a Recovery Strategy or Action Plan for Endangered and Threatened species listed under Schedule 1, and a Management Plan for species listed as Special Concern under Schedule 1. For Endangered and Threatened species, the Recovery Strategy or Action Plan must identify critical habitat, which is the habitat necessary for the survival or recovery of the species. *SARA* prohibits destruction of any part of critical habitat of Endangered or Threatened species without a permit.

Species that were designated at risk by COSEWIC before the creation of *SARA* must be re-assessed according to the criteria of *SARA* before they can be added to Schedule 1. These species are listed on Schedules 2 and 3 and are not yet officially protected under *SARA*. CER Condition 92 requires that Trans Mountain file a summary of any relevant updates under *SARA*, including new Schedule 1 listings and new or amended Recovery Strategies, Action Plans and Management Plans for species that have the potential to be affected by the Project.

2.2 Provincial Standards

2.2.1 Forest and Range Practices Act

Species previously listed under the Identified Wildlife Management Strategy, are now listed under the *FRPA*. The goals of the *FRPA* are to minimize the effects of forest and range practices on Identified Wildlife (which includes vegetation and ecological communities), and to maintain their limiting habitats throughout their current ranges and, where appropriate, their historic ranges on Crown land. Species and ecological communities listed under the *FRPA* are managed through the establishment of wildlife habitat areas and implementation of general wildlife measures, or through other management practices specified in strategic or landscape level plans.

2.2.2 British Columbia Conservation Data Centre Red and Blue Lists

The BC CDC assigns a Provincial Conservation Status Rank to species and ecosystems according to the NatureServe ranking system. These Conservation Status Ranks are used to set conservation priorities and assign each species and ecosystem to the Red, Blue or Yellow list. These lists also help to identify species and ecosystems that can be considered for designation as Endangered or Threatened. Red list species and ecosystems are at risk of being lost. Blue list species and ecosystems are of Special Concern. Yellow list species and ecosystems are at the least risk of being lost (BC CDC 2020a). Definitions of Conservation Status Ranks and Red and Blue list ranks are included in Attachment A of this Technical Data Report.

Red- and Blue-listed species and ecosystems are not protected by specific legislation, however, application of the BC Environmental Mitigation Policy mitigation hierarchy to these species and ecosystems is considered a best practice.

2.2.3 *Weed Control Act and Regulation*

The BC *Weed Control Regulation* includes lists of Provincial weeds (Schedule A, Part I) and Regional weeds (Schedule A, Part II). Provincial weeds are non-native vascular plants that are designated as Noxious within all regions of BC. Regional weeds are non-native vascular plants that are designated as Noxious within the boundaries of corresponding Regional Districts, as identified in the BC *Weed Control Regulation*. Noxious weeds must be controlled as per the BC *Weed Control Act*. In addition to the BC *Weed Control Regulation*, plants listed by the Thompson-Nicola Invasive Plant Management Committee (TNIPMC) (2020) are consulted to determine weeds of management concern and locations that warrant mitigation.

2.2.4 *Old Growth Management Areas*

The BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD) established Old Growth Management Areas (OGMAs) under the BC *Oil and Gas Activities Act* and the *Environmental Protection and Management Regulation* (BC OGC 2018). The BC Oil and Gas Commission (BC OGC) considers all OGMAs in the decision-making process, however, this is discretionary for those OGMAs established under the *FRPA*.

Oil and gas activities should be planned to avoid OGMAs, however where avoidance is not practical, Planning and Operational Measures for OGMAs should be followed. Applications impacting OGMAs (both *BC Oil and Gas Activities Act* and *FRPA*-established OGMAs) require a Mitigation Strategy and Trans Mountain has prepared the Old Growth Management Areas Mitigation and Replacement Plan in fulfilment of Condition 76 to address this.

CER Condition 76 for the Trans Mountain Expansion Project (Old Growth Management Areas Mitigation and Replacement Plan) identifies the individual OGMAs that will be directly impacted by the proposed Project Footprint, specifically by the pipeline construction footprint and new or upgraded access roads. Two distinct processes have been used to identify impacts to OGMAs and the replacement areas that are required to meet two separate regulatory requirements.

Specifically, this Plan includes:

1. those OGMAs that will require compensation through replacement with equivalent old growth areas under BC legislation and regulation; and
2. OGMAs that will require compensation, over and above that required by legislation and regulation, to ensure no net loss to old growth forests within OGMAs as per CER Condition 76.

2.2.5 *Environmental Mitigation Policy for British Columbia*

The BC Ministry of Environment and Climate Change Strategy (BC ENV) Policy for Mitigating Impacts on Environmental Values (BC MOE 2014a) enables the Province to meet its goals for economic prosperity and environmental sustainability and requires consideration of environmental, social and economic values. The Policy is intended to support the environmental portion of informed, integrated and transparent decision-making in the Province’s natural resource sector. It is supported by the Procedures for Mitigating Impacts on Environmental Values (BC MOE 2014b) which are intended to improve the quality, transparency and consistency of information to support existing decision-making processes for mitigating impacts on environmental values and associated components in four areas:

1. Identification of environmental values and associated components
2. Assessment of impacts on environmental values and associated components
3. Application of the environmental mitigation hierarchy to develop mitigation measures
4. Preparation of mitigation plans

The Policy and Procedures do not create new legal requirements or new costs – they support existing authorization processes already in place and are intended to help create efficiencies and reduce costs.

The Policy is based on the application of the environmental mitigation hierarchy, outlined as follows, which is to be applied in a tiered approach, where all feasible options are considered at each step before moving to the next.

- **Avoidance**: measures taken to avoid creating potential effects from the outset, such as considering spatial or temporal factors in project design.
- **Minimization**: measures taken to reduce the duration, intensity or extent of potential effects that cannot be completely avoided.
- **Restoration (On-site)**: measures taken in response to potential residual adverse effects where these effects cannot be completely avoided or reduced.
- **Offset or Compensation**: measures taken to offset or compensate for (a) any residual adverse effect that cannot be avoided, reduced or restored, and (b) any residual adverse effects where there is a time-lag between the residual adverse effects and the effectiveness of the mitigation.

The general principle is that the higher the risk to the valued component, the more protective the mitigation measures should be and the more likely that offset, or compensation measures will also need consideration for any residual adverse effects remaining after Restoration (On-site) (BC MOE 2014b).

3.0 METHODS

This section contains a summary of the methods and data sources used to conduct the desktop review and vegetation field data collection. These methods are consistent with the original application methods.

3.1 Study Area Spatial Boundaries

The Vegetation Regional Study Area (RSA), the Vegetation Local Study Area (LSA), the Reroute corridor and Reroute Footprint were the spatial boundaries in which vegetation data collection for the Reroute were completed, described as follows. The definitions and rationale behind these boundaries are discussed further in Appendix F of the Coldwater Reroute ESA.

The Reroute Footprint assumes certain quantitative values for the area that will be directly disturbed by Reroute-specific activities within the defined Footprint , including: a 45 m pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace); temporary access roads (assumed to use existing access, where practical); and valves (assumed to be within the disturbed right-of-way). The Reroute corridor is a 300 m wide band generally centered on the proposed pipeline centreline (*i.e.*, 150 m on both sides). There are select areas where a variable corridor width of up to 400 m was required to accommodate watercourse crossings and or steep slopes. The corridor approach is used to accommodate potential route realignments, allow for some flexibility during construction and to avoid environmental and cultural resources, if required, prior to finalizing the Reroute. The Vegetation LSA consists of a 300 m wide band generally from the centre of the proposed pipeline corridor (*i.e.*, 150 m on both sides of the proposed pipeline corridor centre) to align with the Wetland LSA. The Vegetation RSA consists of a 2 km wide band generally from the centre of the proposed pipeline corridor (*i.e.,* 1 km on both sides of the proposed pipeline corridor centre) to align with the Wildlife LSA.

The vegetation desktop review focused on the Vegetation RSA. Field surveys were conducted along the Reroute centreline and adjacent areas, current at the time surveys were conducted (*i.e.*, Reroute Footprint).

3.2 Desktop Review

Land cover on the Reroute centreline was determined using Vegetation Resources Inventory (VRI) mapping (Province of BC 2020), imagery interpretation and the results of field reconnaissance conducted along select segments of the Reroute from October 22 and 24, 2019. Land cover mapping was updated in July and September 2020 to include route realignments and access roads and include observations from the 2020 vegetation surveys.

The BC CDC rare plant and lichen species data are provided by biogeoclimatic (BGC) subzones and Natural Resource District and rare ecological community data are provided BGC subzone variant and Natural Resource District (BC CDC 2020a). Lists of potential rare plants, lichens and ecological communities were compiled prior to field work (Appendix A). Habitat information for rare plant and lichen species was added using the Flora of North America Editorial Committee (FNA 1993+), Douglas et al. (2002) and Douglas et al. (1998-2002).

Weeds of management concern identified in the BC *Weed Control Regulation* and Regional Invasive Plants listed by the TNIPMC (TNIPMC 2020) were reviewed prior to field work.

3.3 Field Data Collection

The October 2019 route reconnaissance, October 22 and 24, 2019, was a high-level survey of land covers and habitats present on the Reroute centreline in conjunction with a wildlife reconnaissance.

Vegetation surveys in 2020 were conducted in accordance with established vegetation survey guidelines (BC MOFR and BC MOE 2010; Penny and Klinkenberg 2020) and were consistent with field methodologies described in the CER Condition Plans related to Rare Ecological Communities and Rare Plant Populations (Condition 40) (Trans Mountain 2018). The field crew walked sections of the Reroute centreline and adjacent areas recording identifiable vegetation species, terrestrial and wetland ecosystem classifications and Invasive Plant population observations.

Jacobs Consultancy Canada Inc. (Jacobs) completed an early season vegetation survey over three days from June 11 to 13, 2020, where land access was granted, within representative areas along select segments of the Reroute centreline and adjacent areas. Representative areas were identified using VRI mapping (Province of BC 2020), aerial imagery interpretation and from the October 2019 reconnaissance field visit. Focal areas for rare plant field surveys were those with potential to support rare plants and rare ecological communities, such as within wetlands, riparian areas, rock outcrops, native forests and open grasslands. Incidental observations were also recorded where exposed bedrock or abrupt terrain changes occurred.

The late season vegetation survey was completed from July 14 and 19. The late season survey included functional assessments of wetlands and riparian areas. The late season survey targeted a cross-section of forest stages, potential areas where rare plants and ecological communities could occur and atypical landscape positions, such as rock outcrops, dry south-facing slopes, riparian communities and wetlands on the Reroute centreline and adjacent areas. Several sections of the access road network as part of the Reroute corridor were surveyed during the July survey.

If rare vascular species or ecological communities were observed, searches were conducted to determine the extent of the populations or communities. The populations and communities were mapped and photographed, UTM coordinates were recorded, and detailed reporting forms were completed for future submission to the BC CDC. Species identification was confirmed by other established vegetation specialists, or by comparison with specimens at an appropriate herbarium, when necessary. A modified rare bryophyte and lichen survey was conducted in conjunction with the rare vascular plant survey (RISC 2018). Bryophyte and lichen specimens from representative locations on the Reroute Footprint were collected. Specimens were sent to external regional specialists for identification.

During the two 2020 surveys, weeds of management concern were recorded at all locations where they were observed during the survey, and whether their density was high or low.

To help support and inform the field surveys, participants from Scw’exmx Tribal Council (Nooaitch Indian Band, Nicomen Band and Shackan Indian Band), and Lower Nicola Indian Band accompanied the Jacobs field crew to identify environmental, cultural and social resources along the Reroute.

3.4 Limitations of the Surveys

Although rare vegetation surveys can confirm the presence of rare vegetation, they cannot definitively determine that rare vegetation is not present at a site.

Rare bryophytes and lichens are typically not identified in the field and are instead identified by regional specialists from field sample collections following field work. Therefore, the extent of their populations is typically not known in relation to the Reroute centreline until regional specialists complete the sample identification.

4.0 RESULTS

4.1 Results of Desktop Review

The Reroute corridor is located in the Cascades Natural Resource District and crosses three BGC subzone variants, including the Thompson Very Hot Ponderosa Pine (PP) Variant (PPxh2), Okanagan Very Hot Interior Douglas-fir (IDF) Variant (IDFxh1) and Thompson Very Hot Interior Douglas-fir Variant (IDFxh2) (BC MFLNRORD 2018). All three subzone variants are characterized by a warm, dry climate and long growing seasons (Lloyd et al. 1990).

Land cover along the Reroute centreline includes: wetland (58 m), riparian (1,086 m), river (91 m), shrubs (1,215 m), forest (13,680 m), hay (712 m), tame pasture (1,861 m) and disturbances including roads and existing rights-of-way (28 m). Logged areas that have re-generated to tall shrubs are included with shrubs. Hay vegetation/land cover is cleared annually, whereas tame pasture vegetation/land cover represent areas where cattle grazing occurs and are not cleared annually. There are no native grasslands in the Reroute corridor.

There are 11 vegetation species at risk (*i.e.*, those listed under Schedule 1 of *SARA* or by COSEWIC) (BC CDC 2020a) that are known to occur in the PP and IDF zones and Cascades Natural Resource District listed as follows:

- alkaline wing-nerved moss (*Pterygoneurum kozlovii*), Threatened on *SARA* and by COSEWIC;
- Columbian carpet moss (*Bryoerythrophyllum columbianum*), Special Concern on *SARA* and by COSEWIC;
- dwarf woolly-heads (*Psilocarphus brevissimus* var *brevissimus*), Endangered on *SARA* and by COSEWIC;
- mountain holly fern (*Polystichum scopulinum*), Threatened on *SARA* and by COSEWIC;
- nugget moss (*Microbryum vlassovii*), Endangered on *SARA* and by COSEWIC;
- rusty cord-moss (*Entosthodon rubiginosus*), Endangered on *SARA* and Special Concern by COSEWIC;
- showy phlox (*Phlox speciosa* ssp. *occidentalis*), Threatened on *SARA* and by COSEWIC;
- slender collonia (*Collomia tenella*), Endangered on *SARA* and by COSEWIC;
- stoloniferous pussytoes (*Antennaria flagellaris*), Endangered on *SARA* and by COSEWIC;
- tiny tassle (*Crossidium seriatum*), Special Concern on *SARA* and by COSEWIC; and
- whitebark pine (*Pinus albicaulis*), Endangered on *SARA* and by COSEWIC.

These species and all other Red- and Blue-listed vascular plants, bryophytes and lichens in the PP and IDF zones and Cascades Natural Resource District are included in Appendix A-1.

There are three ecological communities listed under the *FRPA* with potential to occur in the PPxh2, IDFxh1, and IDFxh2 subzones and Cascades Natural Resource District

- water birch/roses (*Betula occidentalis / Rosa* spp.);
- alkali saltgrass – foxtail barley (*Distichlis spicata – Hordeum jubatum*); and
- antelope-brush/needle-and-thread grass (*Purshia tridentata / Hesperostipa comata*).

Red- and Blue-listed rare ecological communities in the PPxh2, IDFxh1 and IDFxh2 subzones and Cascades Natural Resource District are included in Appendix A-2.

No critical habitat for vegetation species at risk is present on the Reroute corridor (ECCC 2019).

BC CDC occurrences of Red- and Blue-listed plants, lichens and ecological communities within 1 km of the Reroute centreline were reviewed, and no BC CDC records were identified (BC ENV 2020).

4.1.1 Old Growth Management Areas

Four non-legal OGMAs are traversed by the Reroute centreline and six non-legal OGMAs are traversed by the Reroute corridor (BC MFLNRORD 2020). No legal OGMAs are expected to be impacted by the Reroute corridor (BC MFLNRORD 2020). Table 1 lists the OGMA name, approximate KP range, area in the corridor and length crossed by the centreline.

TABLE 1

OLD GROWTH MANAGEMENT AREAS ALONG THE COLDWATER REROUTE CENTRELINE AND REROUTE CORRIDOR

OGMA Name	Approximate Corridor KP Ranges	Area in Corridor (ha)	Length Crossed by Centreline (km)
KAM_TME_786	16.4 to 16.7	6.3	0.23
KAM_TME_788	14.7 to 15.5	8.3	0.31
KAM_TME_815	11.2 to 12.1	23.0	0.82
KAM_TME_882	0.15 to 0.40	1.6	0
KAM_TME_884	0.0 to 0.5	4.7	0.1
KAM_TME_886	0.0	0.02	0

Specific locations and mitigation measures related to OGMAs will be provided in the EAS and RSMTs for the Reroute to be filed prior to construction.

4.2 Results of Field Data Collection

4.2.1 Vegetation Communities

The Reroute corridor follows predominately gentle to moderately steep terrain, dominated by shallow to deep morainal till. Exposed bedrock was observed at five sites along the Reroute centreline at AK 2.95, 3.09, 3.45, 15.22 and 16.13 (Appendix B, Photoplates 1 to 4). A steep floodplain terrace slope was observed at the south Coldwater River crossing at AK 16.45 (Appendix B, Photoplate 5).

Forest harvesting and grazing land clearing evidence occurs along sections of the Reroute centreline roughly between AK 2.9 to 4.8, AK 7.3 to 8.0, AK 9.2 to 10.7, AK 13.5 to 14.2 and AK 17.4 to 18.3. Cattle grazing disturbance occurs along most of the Reroute centreline resulting in non-native vegetation introduction. The Reroute centreline also follows transmission line rights-of-way and roads from approximately AK 8.2 to 16.7 leading to abundant non-native and invasive vegetation occurrences. Cleared areas and agricultural land occurs from AK 16.7 to 17.4.

Zonal sites in the PPxh2 (Appendix B, Photoplate 6) are dominated by open forests of ponderosa pine and interior Douglas-fir, with a sparse shrub layer of saskatoon and snowberry, and a well-developed herb layer characterized by bluebunch wheatgrass and other grass species (Lloyd et al. 1990).

Zonal sites in the IDFxh1 (Appendix B, Photoplate 7) and IDFxh2 (Appendix B, Photoplate 8) are dominated by open forests of interior Douglas-fir and ponderosa pine and various shrub, herb and moss species such as birch-leaved spirea, snowberry, saskatoon, Oregon-grape, pinegrass and red-stemmed feathermoss (Lloyd et al. 1990).

Many of the sites series (ecosystems) along the Reroute centreline are designated as potentially listed ecological communities in BC due to their low distribution, including mature and old forest ecosystems, riparian communities and wetlands.

Sixteen occurrences of wetlands, flood associations or riparian communities were observed along the Reroute corridor during the field surveys, including marshes, swamps, open water areas and riparian flood association communities (MacKenzie and Moran 2004).

- One large common cattail marsh (Wm05) was observed off centreline on the west side of the Reroute near AK 9.2 to 9.3 (Appendix B, Photoplate 9).
- Another common cattail (Wm05) was observed in the Reroute corridor at KP 3.35 (Appendix B, Photoplate 10).
- One small hard-stemmed bulrush marsh was observed just off centreline near AK 3.5.
- Two small Bebb's willow – bluejoint reedgrass swamps were observed off centreline near AK 7.0 and 13.95.
- Several riparian communities were observed on the Reroute centreline, including eight wet forest community crossings, classified as trembling aspen – common snowberry – mountain sweet-cicely or Douglas-fir/Douglas maple – red-osier dogwood communities (Appendix B, Photoplate 11).
- Two low bench flood associations along streams were observed on the Reroute centreline, classified as water birch – rose communities (Fl07) (near AK 13.4 and 13.9) (Appendix B, Photoplate 12).
- Four middle bench floodplain communities, classified as a cottonwood – snowberry – rose community (Fm01) (from AK 1.3 to 1.5 and AK 16.5 to 16.7) (Appendix B, Photoplate 13).

A list of species observed at the time of surveys is provided in Appendix C. Species nomenclature is according to the BC Species and Ecosystems Explorer (BC CDC 2020a) with more current taxonomic information drawn from NatureServe (2020a), when necessary.

4.2.2 Rare Vegetation and Rare Ecological Communities

No COSEWIC- or *SARA*-listed species were observed along the Reroute centreline and adjacent areas during the vegetation surveys.

Two observations of an ecological community listed on the *FRPA*, water birch/roses, were made along the Reroute centreline.

One BC CDC-listed moss species (Appendix B, Photoplate 14), one BC CDC-listed lichen species (Appendix B, Photoplate 2), and seven BC CDC-listed ecological communities were observed on the Reroute corridor during the vegetation surveys. A summary of the listed element observations is provided in Table 2.

TABLE 2

RARE PLANTS AND RARE ECOLOGICAL COMMUNITIES OBSERVED ON THE COLDWATER REROUTE CENTRELINE AND REROUTE CORRIDOR

Common Name	Scientific Name	Provincial Designation[1]	Number of Times Observed Along the Centreline and Corridor	Area Observed in the Corridor (ha)
Bryophytes				
cylindrical candlesnuffer moss	*Encalypta affinis* ssp *affinis*	S2S3 Blue	Two observations in corridor and intersects centreline once	Sample collection near AK 3.45 (UTM 10 U 654909E 5548663N)
Lichens				
rockfrog	*Xanthoparmelia camtschadalis*	S1S2 Red	One observation in corridor and does not intersect centreline	Sample collections near AK 11.2 (UTM 10 U 650165 5544714); and near AK 15.2 (UTM 10 U 649290 5540908)
Ecological Communities				
Bebb's willow / bluejoint reedgrass Swamp	*Salix bebbiana / Calamagrostis canadensis* Swamp	S3 Blue	Two observations in corridor and does not cross centreline	2.0
black cottonwood / common snowberry – roses Flood Association	*Populus trichocarpa / Symphoricarpos albus - Rosa* spp. Flood Association	S1 Red	Four observations in corridor and crosses centreline four times	14.0
Hard-stemmed bulrush Marsh	*Schoenoplectus acutus* Marsh	S3 Blue	Two observations in corridor and does not cross centreline	0.03
common cattail Marsh	*Typha latifolia* Marsh	S3 Blue	Two observations in corridor and does not cross centreline	0.7
Douglas-fir / Douglas maple - red-osier dogwood	*Pseudotsuga menziesii / Acer glabrum - Cornus sericea*	S2 Red	Two observations in corridor and crosses centreline twice	1.4
trembling aspen / common snowberry / mountain sweet-cicely	*Populus tremuloides / Symphoricarpos albus / Osmorhiza berteroi*	S1 Red	Six observations in corridor and crosses centreline six times	8.0
water birch / roses Flood Association	*Betula occidentalis / Rosa* spp. Flood Association	*FRPA*-listed S1 Red	Two observations in corridor and crosses centreline twice	0.7

Note: 1 Definitions of Provincial designation are summarized in the footnotes of Appendix A.

Specific locations and mitigation measures related to rare plants and rare ecological communities will be provided in the RSMTs for the Reroute, prior to construction.

4.2.3 Non-Native and Invasive Species

Non-native and invasive plants were observed along the Reroute corridor, especially where the route parallels existing roads and transmission line rights-of-way. Provincially-listed Invasive Plant species observed on the Reroute during field work included: Canada thistle (*Cirsium arvense*), common hound's-tongue (*Cynoglossum officinale*), Dalmatian toadflax (*Linaria genistifolia*), scentless chamomile (*Tripleurospermum inodorum*) and spotted knapweed (*Centaurea stoebe*); and regionally Noxious Weeds: great burdock (*Arctium lappa*), oxeye daisy (*Leucanthemum vulgare*) and sulphur cinquefoil (*Potentilla recta*).

Burdock species, Dalmatian toadflax, common hound's-tongue, spotted knapweed and sulphur cinquefoil are also listed by the TNIPMC as among the current species most threatening to the Thompson-Nicola Regional District (TNIPMC 2020). Trans Mountain has prepared the Weed and Vegetation Management Plan (Condition 45) for the Project.

A list of all non-native species observed at the time of survey is provided in Appendix C.

Mitigation measures related to high-density Invasive Plant species of concern are provided in the Project-specific EPP (Filing ID C01961). Specific locations of high-density Invasive Plant species of concern are provided in the Environmental Resource Maps provided in Appendix G of the Coldwater Reroute ESA. If the Variance Application is approved, EAS and Resource-Specific Mitigation Tables with site-specific mitigation measures will be filed prior to construction.

5.0 SUMMARY AND CONCLUSIONS

One BC CDC-listed moss species and seven BC CDC-listed ecological communities were observed on the Reroute Footprint during the vegetation surveys. The vegetation surveys provided the opportunity to collect information on pre-construction land cover, and search for Red- or Blue-listed vegetation species, Red- or Blue-listed ecological communities and Invasive Plant species of concern within the Reroute Footprint. The information collected during the desktop review and vegetation field survey has informed the mitigation planning and environmental assessment. A summary of key findings identified during the desktop review and fieldwork for the Reroute centreline and corridor is provided in Table 2. Six non-legal OGMAs are traversed by the Reroute corridor (Table 1). Following identification of any disturbed OGMAs, Trans Mountain will apply for appropriate permits where required (BC MFLNRORD and BC ENV). This will include identification of replacement areas as required, prior to construction. Further information can be found in the Old Growth Management Area Mitigation and Replacement Plan (Condition 76) (Filing ID A84120). Mitigation is provided in the Project-specific EPP (Filing ID C01961) and the Reroute-specific EAS and RSMTs to be filed prior to construction. Trans Mountain is committed to meeting the requirements, surveys and goals as set out in the Rare Ecological Community and Rare Plant Population Management Plan (Condition 40) prior to construction.

6.0 REFERENCES

British Columbia Conservation Data Centre (BC CDC). 2020a. *BC Species and Ecosystems Explorer*. Accessed July 2020. http://a100.gov.bc.ca/pub/eswp/.

British Columbia Conservation Data Centre (BC CDC). 2020b. *Provincial Red and Blue Lists*. B.C. Ministry of Environment. Victoria, B.C. Accessed July 2020. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/red-blue-yellow-lists.

British Columbia Ministry of Environment (BC MOE). 2014a. *Policy for Mitigating Impacts on Environmental Values (Environmental Mitigation Policy)*. Working Document – May 13, 2014. Environmental Sustainability and Strategic Policy Division, Ecosystems Branch. Victoria, British Columbia. 4 pp.

British Columbia Ministry of Environment (BC MOE). 2014b. *Procedures for Mitigating Impacts on Environmental Values (Environmental Mitigation Procedures)*. Version 1.0. Working Document – May 27, 2014. Environmental Sustainability and Strategic Policy Division, Ecosystems Branch. Victoria, British Columbia. 68 pp.

British Columbia Ministry of Environment and Climate Change Strategy (BC ENV). 2020. *Species and Ecosystems at Risk – Public Occurrences*. Victoria, BC. (digital data). Downloaded March 25, 2020. https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-publicly-available-occurrences-cdc.

British Columbia Ministry of Forests and Range (BC MOFR) and British Columbia Ministry of Environment (BC MOE). 2010. *Field Manual for Describing Terrestrial Ecosystems,* 2nd ed., Land Management Handbook #25. B.C. Ministry of Forests and Range, Victoria.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2018. *Biogeoclimatic Ecosystem Classification Mapping* (Ver 11, Aug 10, 2018) (digital file). Acquired January 20, 2020. https://catalogue.data.gov.bc.ca/dataset/bec-map.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2020. *Old-Growth Management Areas - Non-Legal - Current*. Victoria, BC. (digital data). Downloaded July 7, 2020. https://catalogue.data.gov.bc.ca/dataset/old-growth-management-areas-non-legal-current.

British Columbia Oil and Gas Commission (BC OGC). 2018. *Environmental Protection and Management Guideline*. Version 2.7. pp. 126.

Crum, H.A. and L.E. Anderson. 1981. *Mosses of Eastern North America*. Columbia University Press, New York, NY. 1330 pp.

Damsholt, K. 2002. *Illustrated Flora of Nordic Liverworts and Hornworts*. Nordic Bryological Society, Lund, Sweden. 840 pp.

Douglas, G.W., D. Meidinger and J.L. Penny. 2002. *Rare Native Vascular Plants of British Columbia*. 2nd Edition. Province of British Columbia, Victoria, BC. 358 pp.

Douglas, G.W., G.B. Straley, D.V. Meidinger and J. Pojar. 1998-2002. *Illustrated Flora of British Columbia*. Volumes 1-8. BC Ministry of Environment, Lands and Parks, BC Ministry of Sustainable Resource Management and BC Ministry of Forests. Victoria, BC.

Environment and Climate Change Canada (ECCC). 2019. *Critical Habitat for Species at Risk, British Columbia* (digital file, detailed polygons). Ottawa, On. Current to February 20, 2019. http://donnees.ec.gc.ca/data/species/developplans/critical-habitat-for-species-at-risk-british-columbia/.

Flora of North America (FNA) Editorial Committee, Eds. 1993+. *Flora of North America North of Mexico.* 20 + Vols. Oxford University Press, New York, NY.

Goward, T., B. McCune and D. Meidinger. 1994. *The Lichens of British Columbia*. Illustrated Keys. Part 1 - Foliose and Squamulose Species. BC Ministry of Forests, Victoria, BC. 181 pp.

Goward, T. 1999. *The Lichens of British Columbia. Illustrated Keys*. Part 2 - Fruticose Species. BC Ministry of Forests, Victoria, BC. 326 pp.

Lloyd, D., K. Angove, G. Hope, and C. Thompson. 1990. *A Guide to Site Identification and Interpretation for the Kamloops Forest Region*. B.C. Minist. For., Res. Branch, Victoria, B.C. Land Manage. Handb. No. 23.

MacKenzie, W.H., Moran, J.R., 2004. *Wetlands of British Columbia: A Guide to Identification, Land Management Handbook*. British Columbia, Ministry of Forests, Forest Science Program, Victoria, BC.

NatureServe. 2020a. *NatureServe Explorer - An Online Encyclopedia of Life*. Accessed July 2020. https://explorer.natureserve.org/.

NatureServe. 2020b. *NatureServe Conservation Status*. Accessed July 2020. https://explorer.natureserve.org/AboutTheData/DataTypes/ConservationStatusCategories.

Penny, J., Klinkenberg, R., 2020. *Rare Plant Inventory Methods,* in: Klinkenberg, B. (Ed.), E-Flora BC: Electronic Atlas of the Flora of British Columbia [Eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver.

Province of British Columbia (Province of BC). 2020. *iMapBC. Geographic Data*. Web-based Mapping. Accessed June 2020. https://www2.gov.bc.ca/gov/content/data/geographic-data-services/web-based-mapping/imapbc.

Resources Information Standards Committee (RISC). 2018. *Inventory and Methods for Rare Plants and Lichens*. Report prepared by Ministry of Environment and Climate Change Strategy Ecosystems Branch for the Resources Information Standards Committee, Victoria, BC.

Thompson-Nicola Invasive Plant Management Committee (TNIPMC). 2020. *Regional Invasive Plants*. Accessed January 2020. http://tnipmc.com/index.php/our-invasive-plants/regional-invasive-plants/.

Trans Mountain Pipeline ULC (Trans Mountain). 2018. *Rare Ecological Community and Rare Plant Population Management Plan for The Trans Mountain Pipeline ULC*. Trans Mountain Expansion Project NEB Condition 40. Revision 4, March 2018. https://apps.cer-rec.gc.ca/REGDOCS/Item/View/3541981

APPENDIX A

POTENTIAL RARE PLANT AND LICHEN SPECIES, AND RARE ECOLOGICAL COMMUNITIES IN THE RANGE OF THE REROUTE

TABLE A-1

POTENTIAL RARE PLANT AND LICHEN SPECIES IN THE BIOGEOCLIMATIC SUBZONES AND NATURAL RESOURCE DISTRICT OF THE REROUTE

Scientific Name	Common Name	Habitat	Provincial Designations[1,2]	Federal Designations[3,4]
VASCULAR PLANTS				
Achnatherum thurberianum	Thurber's needlegrass	Dry forest openings in the steppe zone.	S3 Blue	--
Antennaria flagellaris	stoloniferous pussytoes	Dry, grassy slopes. Flowering from May to June.	S2 Red	Endangered
Berula erecta	cut-leaved water-parsnip	Wet to moist shorelines, streambanks, ditches and open areas. Flowering mid-summer.	S3? Blue	--
Boechera paupercula	tiny suncress	Rock outcrops, talus slopes, gravelly soil in alpine and subalpine habitats. Flowering June to August.	S1S2 Red	--
Claytonia cordifolia	heart-leaved springbeauty	Wet streambanks, pond margins, seepage sites and meadows in the montane zone; locally frequent in SE BC, rare on Vancouver Island. Flowers May to September.	S2S3 Blue	--
Collomia tenella	slender collomia	Dry open areas, sagebrush flats and claybanks in the steppe and montane zones; rare in extreme SC BC, known only from the Princeton area, Similkameen Valley. Flowering in June.	S1S2 Red	Endangered
Crepis atribarba ssp. atribarba	slender hawksbeard	Dry sandy or gravelly grasslands, shrublands and open forests in the steppe and lower montane zones.	S3 Blue	--
Crepis modocensis ssp. rostrata	western low hawksbeard	Dry, open sites. Flowering from May to July.	S2 Red	--
Crepis occidentalis ssp. pumila	gray hawk's-beard	Exposed scree slopes. Flowering from June to July.	S1 Red	--
Eleocharis engelmannii	Englemann's spike-rush	Wet places. Flowering from June to September.	S3 Blue	--
Erigeron leibergii	Leiberg's daisy	Cliffs, ledges, talus, and other rocky habitats, mixed conifers. Flowering June to August (September).	SH Red	--
Erythranthe suksdorfii	Suksdorf's monkey-flower	Moist generally clay soils, in full sun. Flowering in mid-spring.	S3 Blue	--
Lewisia columbiana var. columbiana	Columbia lewisia	Rocky slopes and crevices. Flowering late spring to late summer.	S2S3 Blue	--
Lupinus sulphureus	sulphur lupine	Dry sagebrush flats and forest openings in the steppe and lower montane zones.	S3 Blue	--
Marsilea vestita	hairy water-clover	Shallow lake margins.	S3 Blue	--
Navarretia propinqua	near navarretia	In shallow wet depressions. Flowering from June to September.	S2S3 Blue	--
Oenothera suffrutescens	scarlet gaura	Prairie grassland and roadsides.	S2 Red	--
Olsynium douglasii var inflatum	satinflower	Dry, rocky bluffs and sagebrush slopes. Flowering from early spring to early summer.	S1? Red	--
Phlox speciosa ssp. *occidentalis*	showy phlox	Grassland, shrubland, and open forest habitats.	S2 Red	Threatened
Pinus albicaulis	whitebark pine	Upper subalpine forests. Flowering in mid-summer.	S2S3 Blue	Endangered
Polemonium californicum	California Jacob's-ladder	Open to shaded areas in woodlands. Alpine valleys and flats in granitic soils; boreal zones.	S1S3 Red	--
Polemonium elegans	elegant Jacob's-ladder	Dry cliffs and scree slopes. Flowering from June to September.	S2 Red	--
Polystichum scopulinum	mountain holly fern	Rock outcrops, serpentine soils.	S1S2 Red	Threatened
Potamogeton strictifolius	stiff-leaved pondweed	Lakes. Flowering and fruiting from summer to fall.	S3 Blue	--
Potentilla glaucophylla var. perdissecta	diverse-leaved cinquefoil	Mesic meadows and rock outcrops. Flowering from May to August.	S3 Blue?	--

TABLE A-1 Cont'd

Scientific Name	Common Name	Habitat	Provincial Designations[1,2]	Federal Designations[3,4]
Psilocarphus brevissimus var. brevissimus	dwarf woolly-heads	Moist vernal meadows in the montane zone; rare in SC BC, known only from the Princeton area. Flowering and fruiting mid-March to mid-August.	S1S2 Red	Endangered
Salix amygdaloides	peach-leaf willow	Riverbanks and lakeshores. Flowering from early April to June.	S3 Blue	--
Scrophularia lanceolata	lance-leaved figwort	Moist to mesic sites. Flowering from April to August.	S3 Blue	--
Senecio hydrophiloides	sweet-marsh butterweed	Damp hillsides, non-alkaline meadows, seepage sites. Flowering spring–early summer.	S3 Blue	--
Senecio integerrimus var. ochroleucus	white western groundsel	Dry to moist sites. Flowering in spring.	SH Red	--
Taraxia breviflora	short-flowered evening-primrose	Clay flats	S1 Red	--
Triglochin concinna var. *debilis*	slender arrow-grass	Lakes, alkali ponds, salt flats	S2S3 Blue	--
NON-VASCULAR PLANTS				
Bryoerythrophyllum columbianum	Columbian carpet moss	Compact silt to sandy loam soils in semi-arid steppe and grassland environments.	S2S3 Blue	Special Concern
Crossidium seriatum	tiny tassel	Steep slopes associated with calcareous glacial lake deposits, including road cuts.	S3 Blue	Special Concern
Entosthodon rubiginosus	rusty cord-moss	Silt or clay rich soils in seasonally wet alkaline habitats.	S2S3 Blue	Special Concern
Microbryum vlassovii	nugget moss	Habitats on or near silt-rich post-glacial lacustrine banks in semi-arid steppe environments	S2 Red	Endangered
Pterygoneurum kozlovii	alkaline wing-nerved moss	Seasonally wet, litter covered alkaline soils amongst vascular plants.	S3 Blue	Threatened
LICHENS				
Arctoparmelia subcentrifuga	abrading ring	Open boulder fields	S3 Blue	--
Collema flaccidum	flaking tarpaper	Moss, rock and trees in open coastal environments.	S1S3 Blue	--
Dermatocarpon intestiniforme	quilted stippleback	Rock, stones, pebbles.	S2S3 Blue	--
Fulgensia desertorum	desert sulphur	Soil and eroding sediments in dry habitats.	S2S3 Blue	--
Leptogium californicum	midlife vinyl	Usually on rocks among mosses but occasionally on soil or tree bases.	S2S3 Blue	--
Leptogium schraderi	collapsing vinyl	Short calcareous grassland.	S2? Red	--
Massalongia microphylliza	chopped liver	On sandstone in moist habitats.	S2S3 Blue	--
Neofuscelia loxodes	blistered toad	Rock, very rare on wood or bark.	S3 Blue	--
Neofuscelia subhosseana	erupting toad	Rock.	S2S3 Blue	--
Nephroma isidiosum	pebbled paw	On twigs and bark in mature, humid forest.	S3 Blue	--
Phaeophyscia ciliata	greater eye shadow	Deciduous shrubs in open forests at low elevations.	S3 Blue	--
Physcia dimidiata	exuberant rosette	Grows on bark, especially Juniperus and Artemisia, occasionally on moss over rock, in steppe, open forests, and rock outcrop areas.	S3 Blue	--
Umbilicaria lyngei	puckered rocktripe	On rocks	S3 Blue	--

Sources: BC CDC 2020a,b; Crum 1981; Damsholt 2002; Douglas et al. 1998-200; Douglas et al. 2002; FNA 1993+; Goward et al. 1994; Goward 1999; NatureServe 2020a,b.

Notes:

1 Provincial (S) ranks are assigned by the BC CDC (2020a). Ranks range from 1 (five or fewer occurrences) to 5 (demonstrably secure under present conditions); all definitions below are adapted from NatureServe (2020b).

S1 = Critically Imperiled: At high risk of extirpation in the Province due to very restricted range, very few populations or occurrences, very steep declines, severe threats or other factors.

S2 = Imperiled: At risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats or other factors.

S3 = Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats or other factors.

S4 = Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats or other factors.

S5 = Secure: At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

S#S# = Range Rank: A numeric range rank (*e.g.,* S2S3) is used to indicate the range of uncertainty about the status of the species.

S#? = Inexact numeric rank: denotes inexact numeric rank.

2 BC Provincial List (BC CDC 2020b).

Red List : Any species or ecosystem that is at risk of being lost (Extirpated, Endangered or Threatened).

Blue List: Any species or ecosystem that is of Special Concern.

3 *SARA.* The *SARA* establishes Schedule 1 as the list of species to be protected on all Federal lands in Canada. The *Act* also applies to all lands in Canada for Schedule 1 bird species cited in the *Migratory Birds Convention Act* and Schedule 1 aquatic species as determined by Fisheries and Oceans Canada. *SARA* ranks were obtained from the BC CDC (2020a).

Endangered: a species that is facing imminent Extirpation or Extinction.

Threatened: a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its Extirpation or Extinction.

Special Concern: a species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats. Prohibitions do not apply to species of Special Concern.

4 COSEWIC ranks were obtained from the BC CDC (2020a).

Endangered: a species facing imminent Extirpation or Extinction.

Threatened: a species likely to become Endangered if limiting factors are not reversed.

Special Concern: a species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats.

TABLE A-2

POTENTIAL RARE ECOLOGICAL COMMUNITIES IN THE BIOGEOCLIMATIC SUBZONES AND NATURAL RESOURCE DISTRICT OF THE REROUTE

Scientific Name	Common Name	Provincial Designations[1,2]
Artemisia tridentata / Pseudoroegneria spicata	big sagebrush / bluebunch wheatgrass	S2 Red
Betula occidentalis / Rosa spp.	water birch / roses	*FRPA*-listed S1 Red
Bolboschoenus maritimus var. paludosus Alkali Marsh	seacoast bulrush Alkali Marsh	S1 Red
Distichlis spicata - Hordeum jubatum	alkali saltgrass - foxtail barley	*FRPA*-listed S2S3 Blue
Festuca campestris - (Pseudoroegneria spicata) - Achillea borealis - Cladonia spp.	rough fescue - (bluebunch wheatgrass) - yarrow - clad lichens	S1S2 Red
Festuca idahoensis - Pseudoroegneria spicata - Lupinus sericeus - Koeleria macrantha	Idaho fescue - bluebunch wheatgrass - silky lupine – junegrass	S2 Red
Juncus balticus - Potentilla anserina	Baltic rush - common silverweed	S2 Red
Pinus ponderosa / Pseudoroegneria spicata	ponderosa pine / bluebunch wheatgrass	S3 Blue
Pinus ponderosa / Pseudoroegneria spicata - Festuca campestris	ponderosa pine / bluebunch wheatgrass - rough fescue	S2 Red
Populus tremuloides / Symphoricarpos albus / Osmorhiza berteroi	trembling aspen / common snowberry / mountain sweet-cicely	S1 Red
Populus tremuloides / Symphoricarpos albus / Poa pratensis	trembling aspen / common snowberry / Kentucky bluegrass	S2 Red
Populus trichocarpa - Pseudotsuga menziesii / Acer glabrum – Symphoricarpos albus	black cottonwood-fir / Douglas maple – common snowberry	S1S2 Red
Populus trichocarpa - Pseudotsuga menziesii / Symphoricarpos albus - Cornus sericea	black cottonwood - Douglas-fir / common snowberry - red-osier dogwood	S1S2 Red
Populus trichocarpa / Symphoricarpos albus - Rosa spp.	black cottonwood / common snowberry – roses	S1 Red
Pseudoroegneria spicata - Koeleria macrantha	bluebunch wheatgrass – junegrass	S3 Blue
Pseudotsuga menziesii / Acer glabrum - Cornus sericea	Douglas-fir / Douglas maple - red-osier dogwood	S2 Red
Pseudotsuga menziesii - Pinus ponderosa / Calamagrostis rubescens	Douglas-fir - ponderosa pine / pinegrass	S3 Blue
Pseudotsuga menziesii - Pinus ponderosa / Ceanothus velutinus	Douglas-fir - ponderosa pine / snowbrush	S3 Blue
Pseudotsuga menziesii - Pinus ponderosa / Festuca idahoensis	Douglas-fir - ponderosa pine / Idaho fescue	S3 Blue
Pseudotsuga menziesii - Pinus ponderosa / Pseudoroegneria spicata	Douglas-fir - ponderosa pine / bluebunch wheatgrass	S3 Blue
Pseudotsuga menziesii - Pinus ponderosa / Pseudoroegneria spicata - Calamagrostis rubescens	Douglas-fir - ponderosa pine / bluebunch wheatgrass – pinegrass	S3 Blue
Pseudotsuga menziesii / Symphoricarpos albus - Amelanchier alnifolia	Douglas-fir / common snowberry – saskatoon	S2 Red
Pseudotsuga menziesii / Symphoricarpos albus - Spiraea betulifolia	Douglas-fir / common snowberry - birch-leaved spirea	S2S3 Blue
Puccinellia nuttalliana - Hordeum jubatum	Nuttall's alkaligrass - foxtail barley	S2 Red
Purshia tridentata / Hesperostipa comata	antelope-brush / needle-and-thread grass	*FRPA*-listed S1 Red

TABLE A-2 Cont'd

Scientific Name	Common Name	Provincial Designations[1,2]
Schoenoplectus acutus Deep Marsh	hard-stemmed bulrush Deep Marsh	S3 Blue
Schoenoplectus pungens var. longispicatus Alkali Marsh	long-awned three-square bulrush Alkali Marsh	S1 Red
Symphoricarpos albus - Rosa woodsii	common snowberry - prairie rose	S3 Blue
Thuja plicata - Pseudotsuga menziesii / Cornus stolonifera	western redcedar - Douglas-fir / red-osier dogwood	S3 Blue
Thuja plicata - Pseudotsuga menziesii / Maianthemum racemosum	western redcedar - Douglas-fir / false Solomon's seal	S1 Red
Typha latifolia Marsh	common cattail Marsh	S3 Blue

Source: BC CDC 2020a

Notes:

1 Provincial (S) ranks are assigned by the BC CDC (2020a). Ranks range from 1 (five or fewer occurrences) to 5 (demonstrably secure under present conditions); all definitions below are adapted from NatureServe (2020b).

S1 = Critically Imperiled: At high risk of Extirpation in the Province due to very restricted range, very few populations or occurrences, very steep declines, severe threats or other factors.

S2 = Imperiled: At risk of Extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats or other factors.

S3 = Vulnerable: At moderate risk of Extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats or other factors.

S4 = Apparently Secure: At a fairly low risk of Extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats or other factors.

S5 = Secure: At very low or no risk of Extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats.

S#S# = Range Rank: A numeric range rank (*e.g.*, S2S3) is used to indicate the range of uncertainty about the status of the species.

NR = Unranked: rank not yet assessed.

2 BC Provincial List (BC CDC 2020b)..

Red List: Any species or ecosystem that is at risk of being lost (Extirpated, Endangered or Threatened).

Blue List: Any species or ecosystem that is of Special Concern.

APPENDIX B

PHOTOPLATES

Plate 1. Exposed bedrock near AK 2.75, view looking northwest
(UTM 10U 655423E 5548600N).

Plate 2. Exposed bedrock near AK 12.89, including an observation of a Red-listed lichen on the talus slope, called rockfrog (*Xanthoparmelia camtschadalis*), view looking north
(UTM 10U 655289E 5548580N).

Plate 3. Exposed bedrock near AK 15.02 on south side of drainage gully, view looking northeast (UTM 10U 649299E 5540911N).

Plate 4. Exposed bedrock near AK 15.93 along moderately steep slope, view looking southwest (UTM 10U 648868E 5540111N).

Plate 5. Steep floodplain terrace slope west of the Coldwater River at AK 16.2, view looking east from UTM 10U 648831E 5539819N.

Plate 6. Thompson Very Hot Ponderosa Pine Variant mature forest, zonal site series example (PPxh2/01) at AK 4.7, view looking north from UTM 10U 653659E 5548930N.

Plate 7. Okanagan Very Hot Interior Douglas-fir Variant mature forest, zonal site series example (IDFxh1/01) at AK 12.9, view looking north from UTM 10U 649868E 5542915N.

Plate 8. Thompson Very Hot Interior Douglas-fir Variant mature forest, zonal site series example (IDFxh2/01) near AK 6.0, view looking north from UTM 10U 652371E 5548791N.

Plate 9. Wetland, common cattail marsh (IDFxh2/Wm05) at AK 9.1, view looking north from UTM 10U 650514E 5546525N.

Plate 10. Wetland, common cattail marsh (PPxh2/Wm05) at AK 3.15, view looking south from UTM 10U 654995E 5548646N.

Plate 11. Wet forest, trembling aspen – common snowberry – mountain sweet-cicely riparian community (IDFxh1/00) at AK 8.95, view looking north from UTM 10U 650689E 5546644N.

Plate 12. Flood association, water birch – rose low bench riparian community (IDFxh1/Fl07) at AK 13.2, view looking north from UTM 10U 649759E 5542679N.

Plate 13. Flood association, cottonwood – snowberry – rose middle bench riparian community (IDFxh1/Fm01) at AK 16.4, view looking north from UTM 10U 648892E 5539664N.

Plate 14. Rock outcrop collection site with several species of bryophytes and lichens, including a Blue-listed moss called cylindrical extinguisher moss (*Encalypta affinis* ssp. *affinis*) near AK 11.0, view looking southwest from UTM 10U 650165E 5544714N.

APPENDIX C

OBSERVED VEGETATION SPECIES – BY TYPE AND COMMON NAME

Common Name	Scientific Name
TREES	
balsam poplar	*Populus balsamifera*
Douglas maple	*Acer glabrum* var. *douglasii*
paper birch	*Betula papyrifera*
ponderosa pine	*Pinus ponderosa* var. *ponderosa*
Rocky Mountain Douglas-fir	*Pseudotsuga menziesii* var. *glauca*
trembling aspen	*Populus tremuloides*
white spruce	*Picea glauca*
SHRUBS	
Bebb's willow	*Salix bebbiana*
birch-leaved spirea	*Spiraea lucida*
black gooseberry	*Ribes lacustre*
black twinberry	*Lonicera involucrata* var. *involucrata*
choke cherry	*Prunus virginiana* var. *demissa*
common rabbit-bush	*Ericameria nauseosa* var. *speciosa*
common snowberry	*Symphoricarpos albus* var. *albus*
Drummond's willow	*Salix drummondiana*
dwarf juniper	*Juniperus communis* var. *depressa*
mountain alder	*Alnus incana* ssp. *tenuifolia*
Nootka rose	*Rosa nutkana* ssp. *nutkana*
northern blackcurrant	*Ribes hudsonianum* var. *hudsonianum*
Pacific willow	*Salix lasiandra* var. *lasiandra*
prairie saskatoon	*Amelanchier alnifolia* var. *alnifolia*
prickly rose	*Rosa acicularis* ssp. *sayi*
red raspberry	*Rubus idaeus* ssp. *strigosus*
red-osier dogwood	*Cornus sericea*
Rocky Mountain juniper	*Juniperus scopulorum*
Sitka willow	*Salix sitchensis*
snowbrush	*Ceanothus velutinus* var. *velutinus*
soopolallie	*Shepherdia canadensis*
sticky currant	*Ribes viscosissimum*
thimbleberry	*Rubus parviflorus*
Utah honeysuckle	*Lonicera utahensis*
water birch	*Betula occidentalis*
FORBS, DWARF SHRUBS	
Alaska rein orchid	*Platanthera unalascensis*
American speedwell	*Veronica beccabunga* var. *americana*
American vetch	*Vicia americana*
American water-plantain	*Alisma triviale*
arrowleaf balsamroot	*Balsamorhiza sagittata*
arrow-leaved coltsfoot	*Petasites frigidus* var. *sagittatus*
ballhead waterleaf	*Hydrophyllum capitatum* var. *capitatum*
baneberry	*Actaea rubra*
barestem desert-parsley	*Lomatium nudicaule*
blue-leaved cinquefoil	*Potentilla glaucophylla* var. *glaucophylla*
blunt-fruited sweet-cicely	*Osmorhiza depauperata*
brown-eyed Susan	*Gaillardia aristata*
Canada violet	*Viola canadensis var. rugulosa*
chocolate lily	*Fritillaria affinis*
cleavers	*Galium aparine*
common cattail	*Typha latifolia*
common duckweed	*Lemna minor*

Common Name	Scientific Name
common horsetail	*Equisetum arvense*
common mare's-tail	*Hippuris vulgaris*
common mitrewort	*Mitella nuda*
common rabbit-bush	*Ericameria nauseosa* var. *speciosa*
cow-parsnip	*Heracleum maximum*
cut-leaved daisy	*Erigeron compositus*
desert pussytoes	*Antennaria rosea* ssp. *arida*
early blue violet	*Viola adunca* var. *adunca*
edible thistle	*Cirsium edule* var. *macounii*
false Solomon's-seal	*Maianthemum racemosum* ssp. *amplexicaule*
fern-leaved desert-parsley	*Lomatium dissectum*
field mint	*Mentha arvensis*
fireweed	*Chamaenerion angustifolium*
fragile fern	*Cystopteris fragilis*
graceful cinquefoil	*Potentilla gracilis* var. *fastigiata*
graceful cinquefoil	*Potentilla gracilis* var. *flabelliformis*
graceful cinquefoil	*Potentilla gracilis* var. *gracilis*
grass-leaved death-camas	*Toxicoscordion venenosum* var. *gramineum*
Great Basin nemophila	*Nemophila breviflora*
green-flowered wintergreen	*Pyrola chlorantha*
hairy arnica	*Arnica mollis*
heart-leaved arnica	*Arnica cordifolia*
hemlock water-parsnip	*Sium suave*
hillside milk-vetch	*Astragalus collinus* var. *collinus*
kinnikinnick	*Arctostaphylos uva-ursi*
lance-leaved stonecrop	*Sedum lanceolatum* var. *lanceolatum*
large-fruited desert-parsley	*Lomatium macrocarpum*
large-leaved avens	*Geum macrophyllum* var. *macrophyllum*
leafy aster	*Symphyotrichum foliaceum* var. *foliaceum*
lemonweed	*Lithospermum ruderale*
long-leaved starwort	*Stellaria longifolia*
low hawksbeard	*Crepis modocensis* ssp. *modocensis*
low pussytoes	*Antennaria dimorpha*
meadow arnica	*Arnica chamissonis*
meadow birds-foot trefoil	*Acmispon denticulatus*
meadow death-camas	*Toxicoscordion venenosum* var. *venenosum*
miner's-lettuce	*Claytonia perfoliata* ssp. *perfoliata*
mountain death-camas	*Anticlea elegans*
mountain sweet-cicely	*Osmorhiza berteroi*
narrow-leaved collomia	*Collomia linearis*
narrow-leaved hawkweed	*Hieracium umbellatum*
narrow-leaved montia	*Montia linearis*
narrow-leaved stephanomeria	*Stephanomeria tenuifolia*
nodding onion	*Allium cernuum*
northern bedstraw	*Galium boreale*
northern gentian	*Gentianella amarella* ssp. *acuta*
northern goldenrod	*Solidago multiradiata*
northern tansymustard	*Descurainia sophioides*
old man's whiskers	*Geum triflorum* var. *triflorum*
orange arnica	*Arnica fulgens*
parsnip-flowered buckwheat	*Eriogonum heracleoides* var. *heracleoides*
Philadelphia daisy	*Erigeron philadelphicus* var. *philadelphicus*
pinedrops	*Pterospora andromedea*
pretty oxytrope	*Oxytropis sericea* var. *speciosa*
pretty shootingstar	*Primula pauciflora* var. *pauciflora*
purple peavine	*Lathyrus nevadensis* var. *nevadensis*
purple-leaved willowherb	*Epilobium ciliatum* ssp. *ciliatum*

Common Name	Scientific Name
rattlesnake-plantain	*Goodyera oblongifolia*
Richardson's tansymustard	*Descurainia incisa* ssp. *incisa*
rosy pussytoes	*Antennaria rosea* ssp. *rosea*
rosy twistedstalk	*Streptopus lanceolatus* var. *curvipes*
rough-fruited fairybells	*Prosartes trachycarpa*
round-leaved alumroot	*Heuchera cylindrica* var. *cylindrica*
sagebrush buttercup	*Ranunculus glaberrimus* var. *glaberrimus*
scarlet paintbrush	*Castilleja miniata* var. *miniata*
sharptooth angelica	*Angelica arguta*
showy aster	*Eurybia conspicua*
showy daisy	*Erigeron speciosus*
showy Jacob's-ladder	*Polemonium pulcherrimum* var. *pulcherrimum*
showy pussytoes	*Antennaria pulcherrima* ssp. *pulcherrima*
shrubby penstemon	*Penstemon fruticosus* var. *fruticosus*
silky lupine	*Lupinus sericeus* var. *sericeus*
Sitka columbine	*Aquilegia formosa* var. *formosa*
slender hawksbeard	*Crepis atribarba* ssp. *originalis*
slender hawkweed	*Hieracium gracile*
small-flowered blue-eyed Mary	*Collinsia parviflora*
small-flowered forget-me-not	*Myosotis laxa*
small-flowered fringecup	*Lithophragma parviflorum*
small-flowered penstemon	*Penstemon procerus* var. *procerus*
spreading dogbane	*Apocynum androsaemifolium* var. *androsaemifolium*
star-flowered false Solomon's-seal	*Maianthemum stellatum*
sticky cinquefoil	*Drymocallis glandulosa* var. *glandulosa*
stinging nettle	*Urtica dioica* ssp. *gracilis*
tall bluebells	*Mertensia paniculata var. paniculata*
tall Oregon-grape	*Berberis aquifolium*
Thompson's paintbrush	*Castilleja thompsonii*
Thompson's woodland-star	*Lithophragma thompsonii*
thread-leaved phacelia	*Phacelia linearis*
tiger lily	*Lilium columbianum*
timber milk-vetch	*Astragalus miser var. miser*
tiny mousetail	*Myosurus minimus*
trailing daisy	*Erigeron flagellaris*
umber pussytoes	*Antennaria umbrinella*
upland larkspur	*Delphinium nuttallianum*
western meadowrue	*Thalictrum occidentale*
western springbeauty	*Claytonia lanceolata*
western stickseed	*Lappula occidentalis* var. *occidentalis*
white hawkweed	*Hieracium albiflorum*
white pussytoes	*Antennaria microphylla*
white water-buttercup	*Ranunculus aquatilis* var. *aquatilis*
white-veined wintergreen	*Pyrola picta*
wild strawberry	*Fragaria virginiana* ssp. *glauca*
wood strawberry	*Fragaria vesca* ssp. *bracteata*
woollypod milk-vetch	*Astragalus purshii* var. *purshii*
yellow bell	*Fritillaria pudica*
GRASSES, SEDGES, RUSHES	
Baltic rush	*Juncus balticus* ssp. *ater*
Bellard's kobresia	*Kobresia myosuroides*
blue wildrye	*Elymus glaucus* ssp. *glaucus*
bluebunch wheatgrass	*Pseudoroegneria spicata*
bluejoint reedgrass	*Calamagrostis canadensis* var. *canadensis*
common spike-rush	*Eleocharis palustris*
Cusick's bluegrass	*Poa cusickii* ssp. *epilis*
dunhead sedge	*Carex phaeocephala*

Common Name	Scientific Name
Falkland Island sedge	*Carex macloviana*
field sedge	*Carex praegracilis*
foxtail barley	*Hordeum jubatum* ssp. *jubatum*
hard-stemmed bulrush	*Schoenoplectus acutus*
inflated sedge	*Carex exsiccata*
junegrass	*Koeleria macrantha*
Kentucky bluegrass	*Poa pratensis* ssp. *agassizensis*
large-flowered triteleia	*Triteleia grandiflora*
low northern sedge	*Carex concinna*
pinegrass	*Calamagrostis rubescens*
purple reedgrass	*Calamagrostis purpurascens*
Rocky Mountain fescue	*Festuca saximontana* var. *saximontana*
Ross' sedge	*Carex rossii*
rough fescue	*Festuca campestris*
slender-beaked sedge	*Carex athrostachya*
spike trisetum	*Trisetum spicatum*
tall mannagrass	*Glyceria elata*
western fescue	*Festuca occidentalis*
MOSSES, LICHENS, LIVERWORTS	
abrading camouflage	*Melanelixia subaurifera*
acute ragged moss	*Brachythecium acutum*
antlered pixie	*Cladonia subulata*
apple pelt	*Peltigera malacea*
Austria Timmia moss	*Timmia austriaca*
badge moss	*Plagiomnium insigne*
bighorn pixie	*Cladonia cornuta ssp. cornuta*
bird-splat lichen	*Lecanora muralis*
black-bellied pelt	*Peltigera rufescens*
boreal pixie-cup	*Cladonia borealis*
born-again pelt	*Peltigera praetextata*
bright silk moss	*Plagiothecium laetum*
brown-eyed sunshine	*Vulpicida canadensis*
bronzed pixie	*Cladonia gracilis ssp. turbinata*
cinnamon pelt	*Peltigera cinnamomea*
coast creeping moss	*Conardia compacta*
common broom moss	*Dicranum scoparium*
common cord moss	*Funaria hygrometrica*
common nodding moss	*Pohlia nutans*
creeping feather moss	*Amblystegium serpens*
crinkled wrinkle	*Tuckermannopsis platyphylla*
curly thatch moss	*Dicranoweisia cirrata*
cylindrical extinguisher moss	*Encalypta affinis ssp. affinis*
deadman's camouflage	*Melanohalea subelegantula*
dense-rooted Leske's moss	*Pseudoleskea radicosa var. radicosa*
dog bone	*Hypogymnia tubulosa*
dung moss species	*Splachnum sp.*
dusky fork moss	*Dicranum fuscescens*
edible horsehair	*Bryoria fremontii*
elegant beaked moss	*Eurhynchiastrum pulchellum*
emery rocktripe	*Umbilicaria phaea*
flattened thornbush	*Kaernefeltia merrillii*
forking bone	*Hypogymnia imshaugii*
fragile broom moss	*Dicranum tauricum*
frizzles twisted moss	*Tortella tortuosa var. tortuosa*
golden thread moss	*Leptobryum pyriforme*
goodlooking readhead	*Nodobryoria abbreviata*
granulating pixie-cup	*Cladonia chlorophaea*

Common Name	Scientific Name
greater pied pixie	*Cladonia phyllophora*
greater ribbed pixie	*Cladonia symphycarpia*
green-eyed rockbright	*Rhizoplaca melanophthalma*
grey starburst	*Parmeliopsis hyperopta*
Grimmia moss species	*Grimmia sp*
hair-pointed Grimmia moss	*Grimmia trichophylla*
hammered crottle	*Parmelia sulcata*
hard cowpie	*Diploschistes scruposus*
juniper haircap moss	*Polytrichum juniperinum*
Kneiff's hook moss	*Drepanocladus aduncus*
Leptodictyum moss species	*Leptodictyum humile*
lesser ribbed pixie	*Cladonia cariosa*
little groove moss	*Aulacomnium androgynum*
low-rise pixie	*Cladonia macrophyllodes*
mama littlehorn pixie	*Cladonia coniocraea*
many-flowered Pylaisia moss	*Pylaisiella polyantha*
monk's hood	*Hypogymnia physodes*
mountain moss	*Roellia roellii*
mountain readhead	*Nodobryoria oregana*
nebulous camouflage	*Montanelia disjuncta*
nodding moss species	*Pohlia sp.*
Oregon beaked moss	*Eurhynchium oreganum*
pagoda pixie	*Cladonia cervicornis ssp. verticillata*
pale-footed horsehair	*Bryoria fuscescens*
pebbled crottle	*Parmelia saxatilis*
pebbled pixie-cup	*Cladonia pyxidata*
pipecleaner moss	*Rhytidiopsis robusta*
Plitt's rockfrog	*Xanthoparmelia plittii*
powder-ringed beard	*Usnea lapponica*
progressive camouflage	*Melanohalea elegantula*
ragbag	*Platismatia glauca*
ragged moss species	*Brachythecium sp.*
ragged moss species	*Sciurohypnum sp.*
red roof moss	*Ceratodon purpureus*
red-mouthed leafy moss	*Mnium spinulosum*
red-stemmed feathermoss	*Pleurozium schreberi*
riparian feather moss	*Leptodictyum riparium*
rockfrog	*Xanthoparmelia camtschadalis*
Rota's feather moss	*Brachythecium rotaeanum*
royal pixie-cup	*Cladonia carneola*
serrate trumpet moss	*Tayloria serrata*
shaggy gooseneck moss	*Rhytidiadelphus triquetrus*
sickleleaf hook moss	*Sanionia uncinata*
sidewalk screw moss	*Syntrichia ruralis*
silver-lined wrinkle	*Tuckermannopsis chlorophylla*
smooth bristle moss	*Orthotrichum laevigatum*
step moss	*Hylocomium splendens*
streaked horsehair	*Bryoria pikei*
swollen dogtooth moss	*Cynodontium strumiferum*
tall clustered thread moss	*Bryum pseudotriquetrum*
thread moss	*Ptychostomum bimum*
trumpeting pixie	*Cladonia fimbriata*
tight-tufted thread moss	*Ptychostomum creberrimum*
toothless Grimmia moss	*Grimmia anodon*
tufted Bryum moss	*Gemmabryum caespiticium*
valley wolf	*Letharia vulpina*
woodsy leafy moss	*Plagiomnium cuspidatum*

Common Name	Scientific Name
WEEDS, AGRONOMICS[2,3]	
alfalfa	*Medicago sativa* ssp. *sativa*
black medic	*Medicago lupulina*
bull thistle	*Cirsium vulgare*
Canada thistle	***Cirsium arvense***
cheatgrass	*Bromus tectorum*
clasping-leaved pepper-grass	*Lepidium perfoliatum*
common hound's-tongue	***Cynoglossum officinale***
common plantain	*Plantago major*
common stork's-bill	*Erodium cicutarium* ssp. *cicutarium*
common timothy	*Phleum pratense* ssp. *pratense*
creeping buttercup	*Ranunculus repens*
crested wheatgrass	*Agropyron cristatum*
curled dock	*Rumex crispus*
curly-cup gumweed	*Grindelia squarrosa* var. *squarrosa*
cursed buttercup	*Ranunculus sceleratus* var. *sceleratus*
Dalmatian toadflax	***Linaria dalmatica* ssp. *dalmatica***
European rush	*Juncus effusus* ssp. *effusus*
field chickweed	*Cerastium arvense* ssp. *arvense*
field forget-me-not	*Myosotis arvensis*
flixweed	*Descurainia sophia*
great burdock	***Arctium lappa***
great mullein	*Verbascum thapsus*
green sorrel	*Rumex acetosa*
Kentucky bluegrass	*Poa pratensis* ssp. *pratensis*
lance-leaved water-plantain	*Alisma lanceolatum*
littlepod flax	*Camelina microcarpa*
Loesel's tumble-mustard	*Sisymbrium loeselii*
oxeye daisy	***Leucanthemum vulgare***
pale alyssum	*Alyssum alyssoides*
perennial ryegrass	*Lolium perenne*
pineapple weed	*Matricaria discoidea*
prickly lettuce	*Lactuca serriola*
quackgrass	*Elymus repens*
red clover	*Trifolium pratense*
scentless chamomille	***Tripleurospermum inodorum***
self-heal	*Prunella vulgaris* ssp. *vulgaris*
shepherd's purse	*Capsella bursa-pastoris*
smooth brome	*Bromus inermis*
spotted knapweed	***Centaurea stoebe* ssp. *micranthos***
stinging nettle	*Urtica dioica* ssp. *dioica*
sulphur cinquefoil	***Potentilla recta***
tall tumble-mustard	*Sisymbrium altissimum*
wall lettuce	*Mycelis muralis*
white clover	*Trifolium repens*
white sweet-clover	*Melilotus albus*
yarrow	*Achillea millefolium*
yellow rattle	*Rhinanthus minor*
yellow salsify	*Tragopogon dubius*

Notes:

1 Nomenclature follows the BC Species and Ecosystem Explorer (BC CDC 2020a). Common names are taken from NatureServe (2020a) when not provided by the BC Species and Ecosystem Explorer

2 **Bold** font denotes Provincially and Regionally Noxious weed species.

3 The status of species as native or not is according to the BC Species and Ecosystem Explorer (BC CDC 2020a).

APPENDIX B

FISHERIES TECHNICAL DATA REPORT

FISHERIES (BRITISH COLUMBIA) TECHNICAL REPORT FOR THE COLDWATER WEST ALTERNATIVE REROUTE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

October 2020

Prepared for:

Trans Mountain Pipeline ULC
Kinder Morgan Canada Inc.
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

Triton Environmental Consultants
1326 McGill Road
Kamloops, BC V2C 6N6
Ph: 250-851-0023

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 PROJECT OVERVIEW

An overall project description for the Trans Mountain Expansion Project (TMEP or the Project) is provided in Section 2.0 of Volume 5A of the Environmental and Socio-Economic Assessment (ESA) – Biophysical (TERA Environmental Consultants [TERA] December 2013; Filing ID A3S1L3).

Fish and fish habitat assessments conducted for the TMEP (excluding the West Alternative) are detailed in the Fisheries (BC) Technical Report 5C-7 in Volume 5C (Triton 2013; Filing ID A3S2C1-A3S2G5) and the Supplemental Fisheries (BC) Technical Report (Triton 2014; Filing ID A4H1Z2-A4H1Z7), with subsequent revisions to the watercourse crossing inventory filed to the Canadian Energy Regulator (CER) (Condition 43 update) in 2019 (Filing ID A6W5S0).

This technical report provides updates to the watercourse crossing inventory that would result from the Coldwater Western Alternative Route (herein referred to as the West Alternative) between KP 929.48 and KP 946.86. Triton Environmental Consultants (Triton) was retained by Trans Mountain to conduct fish and fish habitat assessments along the proposed reroute in the fall of 2019 and summer of 2020. The results of these assessments are summarized in this report.

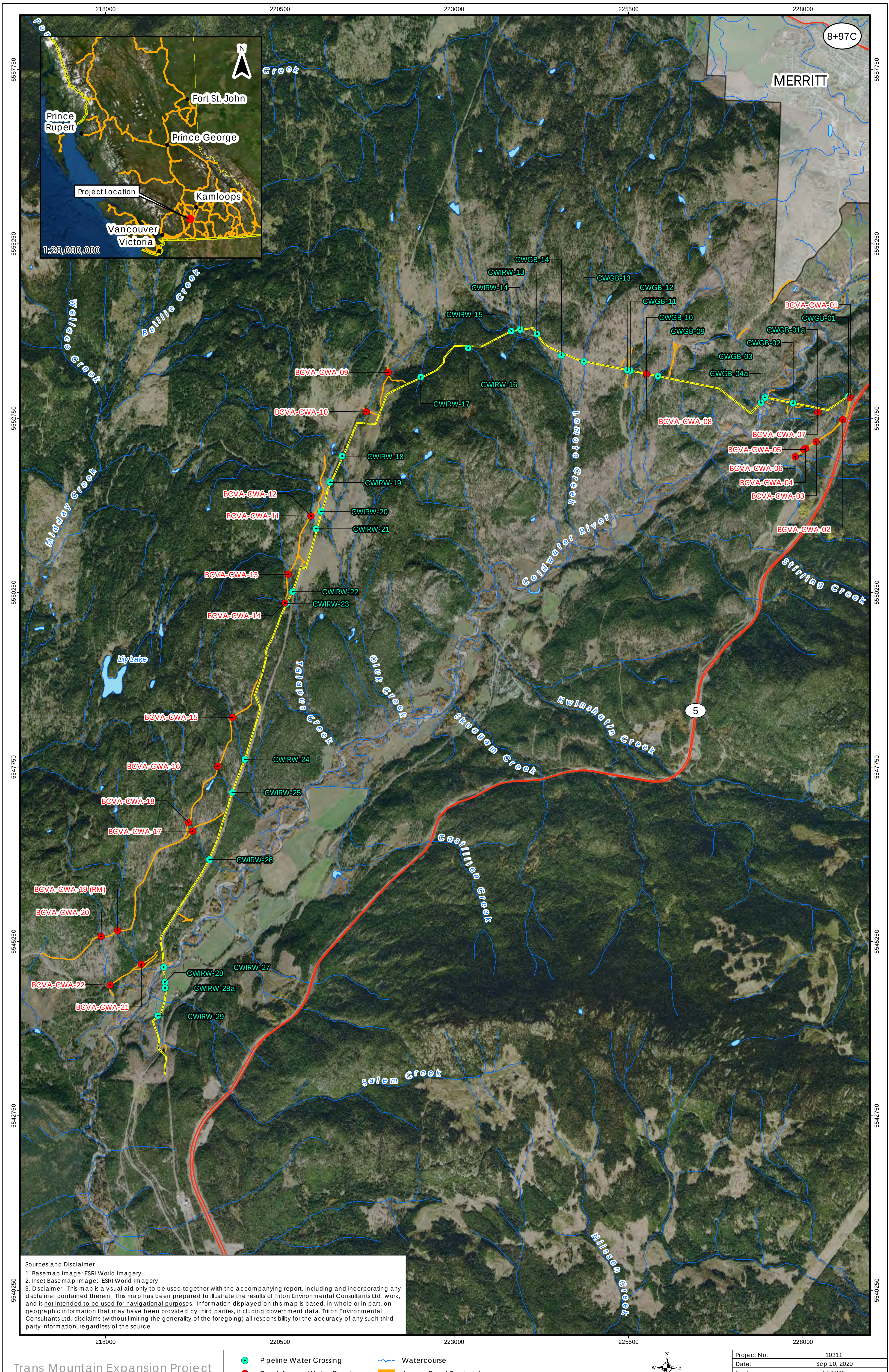
1.1.1 Fish and Fish Habitat Assessments

Prior to the 2019 and 2020 field assessments, Triton, on behalf of Trans Mountain, conducted background literature reviews and field investigations for the TMEP (2012-2014). The information collected was used to develop a comprehensive database comprising of relevant historical and existing fish and fish habitat information, including the Coldwater River and many of its tributaries, part of which would be traversed by the West Alternative.

This report summarizes the fish and fish habitat data that were collected during the desktop review, previous field studies conducted, and the fall 2019, and summer 2020 field assessments. Field assessments were conducted by Qualified Environmental Professionals (QEPs) and data were reviewed by a senior aquatic biologist who is a Registered Professional Biologist (R.P.Bio.). Five Indigenous technicians from four Indigenous communities were also subcontracted to Triton to assist the Triton QEPs during the July 2020 field assessments. The results of the 2019 and 2020 field programs are summarized into a revised Pipeline Watercourse Crossing Inventory (Appendix A) and Road Access Watercourse Crossing Inventory (Appendix B).

1.1.2 Pipeline Routing Updates for the Proposed West Alternative

The proposed West Alternative would result in the addition of 28 new potential watercourse crossings, which were investigated in October and November 2019 and July 2020 (Table 1-1). Additionally, access to the West Alternative would result in 21 watercourse crossings by proposed access roads (Table 1-2). An overview map showing proposed pipeline and access road watercourse crossings for the West Alternative is shown Figure 1-1 below.



Sources and Disclaimer

1. Basemap Image: ESRI World Imagery
2. Inset Basemap Image: ESRI World Imagery
3. Disclaimer: This map is a visual aid only to be used together with the accompanying report, including and incorporating any disclaimer contained therein. This map has been prepared to illustrate the results of Triton Environmental Consultants Ltd. work, and is not intended to be used for navigational purposes. Information displayed on this map is based, in whole or in part, on geographic information that may have been provided by third parties, including government data. Triton Environmental Consultants Ltd. disclaims (without limiting the generality of the foregoing) all responsibility for the accuracy of any such third party information, regardless of the source.

Trans Mountain Expansion Project

Coldwater West Alternative Route Project Overview

●	Pipeline Water Crossing	~	Watercourse
●	Road Access Water Crossing	🟧	Access Road Footprint
⁄\/	Coldwater West Alternative Route Centerline	▨	Municipality
~	Highway	▨	Waterbody

N
W E
S

Meters
0 200 400 800 1,200 1,600

Project No:	10311
Date:	Sep 10, 2020
Scale:	1:50,000
Map Projection:	UTM Zone 11 (NAD 1983)

TRITON
Environmental Consultants

N:\ACTIVE\10311_TMEP_2019\ArcProProject1\ArcMap\10311_ColdwaterAlternativeReroute_PO_20200910.mxd

TABLE 1-1

POTENTIAL WATERCOURSE CROSSINGS (PIPELINE) ALONG THE PROPOSED WEST ALTERNATIVE

Number of New Crossings	Master Crossing Number
28	CWGB-01, CWGB-02, CWGB-03, CWGB-04a, CWGB-09, CWGB-10, CWGB-11, CWGB-12, CWGB-13, CWGB-14, CWIRW-13, CWIRW-14, CWIRW-15, CWIRW-16, CWIRW-17, CWIRW-18, CWIRW-19, CWIRW-20, CWIRW-21, CWIRW-22, CWIRW-23, CWIRW-24, CWIRW-25, CWIRW-26, CWIRW-27, CWIRW-28, CWIRW-28a, CWIRW-29

TABLE 1-2

POTENTIAL WATERCOURSE CROSSINGS (ACCESS ROADS) FOR THE PROPOSED WEST ALTERNATIVE

Number of New Crossings	Master Crossing Number
21	BCVA-CWA-01, BCVA-CWA-02, BCVA-CWA-03, BCVA-CWA-04, BCVA-CWA-05, BCVA-CWA-06, BCVA-CWA-08, BCVA-CWA-09, BCVA-CWA-10, BCVA-CWA-11, BCVA-CWA-12, BCVA-CWA-13, BCVA-CWA-14, BCVA-CWA-15, BCVA-CWA-16, BCVA-CWA-17, BCVA-CWA-18, BCVA-CWA-19 (RM), BCVA-CWA-20 (RM), BCVA-CWA-21 (RM), BCVA-CWA-22 (RM)

1.2 REGULATORY STANDARDS

This report was prepared in order to meet filing requirements under the *Canada Energy Regulator (CER) Act,* particularly the requirements pertaining to fish and fish habitat and species at risk (Table A-2 of the *Filing Manual* [CER 2020]) within the proposed West Alternative. This report also provides the information required to ensure proposed activities on the specified crossings adhere to the federal *Fisheries Act*, the *Navigation Protection Act* (NPA), and associated CER policies and processes. In addition, this report aims to satisfy several British Columbia (BC) provincial standards, including the *Forest and Range Practices Act (FRPA)*, and depending on the nature of the proposed activities, the *OGAA, Water Sustainability Act*, *Land Act*, *Mines Act,* and *Drinking Water Protection Act*. The applicable regulatory agencies and national and provincial standards and guidelines are detailed further in Section 1.5 of Technical Report 5C-7 in Volume 5C (Triton 2013; Filing ID A3S2C1) and in Sections 1.5 and 1.6 of the Supplemental Fisheries (BC) Technical Report (Triton 2014; Filing ID A4H1Z2). Recent updates to the *Fisheries Act* provisions and the National Energy Board (now the CER) are outlined below.

1.3 OBJECTIVES

The fall 2019 and summer 2020 fish and fish habitat assessments were completed in order to satisfy application and regulatory requirements for Project components occurring in British Columbia; to support an environmental and socio-economic assessment of the Project; and to provide technically sound and relevant recommendations for pipeline construction along the proposed West Alternative.

Specifically, the purpose of the 2019 and 2020 assessments was to investigate fish and fish habitat potential at 28 potential watercourse crossings (and associated contingency crossings, if applicable) along the proposed West Alternative between KP 929.48 and KP 946.86, as well as 21 potential watercourses that intersect planned access roads for the proposed pipeline route. The primary objectives were to:

- Document fish use, aquatic and riparian habitat quality, and habitat sensitivity at and adjacent (upstream and downstream) to the centre of the proposed (revised) pipeline corridor;
- Record any species at risk or of special concern and determine fish habitat sensitivity to disturbances associated with pipeline construction and operations; and,

- Provide recommendations from a QEP (including pipeline and vehicle/equipment crossing techniques, timing, and locations) to help ensure the quantity and productive capacity of the aquatic environment is maintained and no Harmful Alteration, Disruption or Destruction (HADD) of fish habitat or death of fish is caused by the Project.

Five Indigenous technicians from various Indigenous communities or organizations, including Esh-Kn-Am, Scw'exmx Tribal Council, Lower Nicola Indian Band and Nooaitch Indian Band were also subcontracted to Triton for the July 2020 field assessments. All the technicians were required to complete the Trans Mountain visitor orientation prior to the start of the field program. All staff were also required to complete COVID-19 self-declaration forms prior to arriving onsite, as well as conduct Level 3 cleaning of vehicles and provide proof of completion (Level 2-3 Cleaning Record) to the Lead Environmental Inspector for the Project.

2.0 METHODS

In the fall of 2019, fish and fish habitat assessments were completed along the proposed West Alternative between KP 946.86 to KP 929.48. However, in the spring of 2020, further route refinements resulted in a need for additional field investigations along the eastern portion of the West Alternative.

Study area boundaries for the fish and fish habitat assessments are defined in Section 3.1.1 of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C1). In general, each watercourse crossing was assessed from 100 m upstream to 300 m downstream from the proposed pipeline crossing. For non-channels, such as non-classified drainages (NCD) and no visible channels (NVCs), this distance was modified to a total distance of 100 m (or as determined by the QEP).

Section 3.1.3 of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C1) provides a detailed description of assessment indicators and measurement endpoints. The following indicators for fish and fish habitat were assessed, with a focus on fish species of management concern:

- Instream fish habitat potential;
- Riparian habitat value;
- Potential for fish mortality or injury directly through construction related activities (site preparation, clearing, and grubbing) or indirectly through potential physical infilling of downstream habitats and temporal delays in fish migration during construction. Indirect effects may include isolation, fragmentation and sedimentation of habitats (loss of migration corridors);
- Presence/absence of indicator species selected for the Project (salmonids); and,
- Presence/absence of listed species of concern (*i.e.,* listed under the *Species at Risk Act* [*SARA*], the Committee on the Status of Endangered Wildlife in Canada [COSEWIC], and provincial lists).

Indicator species were previously identified as important species of cultural, recreational, ecological, and/or Aboriginal concern that are distributed widely throughout the province and encountered frequently in watercourses along the proposed pipeline/power line corridors, access roads, and areas downstream, as supported by fish and fish habitat assessments and/or literature reviews. While it is understood the term ‘cultural, recreational, and Aboriginal’ or ‘CRA’ species is no longer in use under the new *Fisheries Act* provisions, these species still tend to be of higher management concern, as they are deemed important for regional fisheries and/or Indigenous peoples, and are generally more sensitive to perturbations from instream works during pipeline construction or operations works. Indicator species relevant to the West Alternative include bull trout/Dolly Varden (*Salvelinus confluentus*), Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and rainbow trout/steelhead (*Oncorhynchus mykiss*). Information about these species is provided in Sections 4.3 through 4.5 of Technical Report 5C-7 in Volume 5C (Triton December 2013, Filing ID A3S2C1).

2.1 WATERCOURSE CROSSING DATABASE

Twenty-eight (28) potential watercourses that intersect the proposed pipeline route were identified using GIS and the Freshwater Atlas (FWA) of BC (TRIM maps at 1:20,000 scale). Twenty-one (21) potential watercourses that intersect proposed access roads for the West Alternative were also investigated. Each potential watercourse crossing was assigned a unique crossing number and assembled into a base crossing list for the compilation of historical fish and fish habitat information and collection of fisheries-related field data. In October and November 2019 and July 7 to 8, 2020, field crews visited the proposed pipeline and access road crossings, with the exception of 4 ‘risk-managed’ (RM) access road crossing sites, to spatially verify each mapped crossing using hand-held Global Positioning System (GPS) units, and to conduct fish and fish habitat assessment at each crossing location. Any additional unmapped drainages found in the field, while traversing the proposed alignment, were also added to the inventory if they exhibited watercourse or drainage features and will require permitting under the *Water Sustainability Act*.

2.2 REVIEW OF HISTORICAL FISH AND FISH HABITAT RELATED INFORMATION

Prior to the field investigations, a desktop review was conducted to obtain baseline conditions within the study area boundaries. The review considered existing land uses, watershed descriptions, known fish distributions, potential barriers to fish migration, potential for species of management concern, and known geographical stock information for Pacific salmon species. While the review focused on named watercourse crossings, information about unnamed potential watercourse crossings was also gathered, where available. Historical fish and fish habitat data for the study area was generally confined to the Coldwater River and Salem Creek (Table 3-1) as well as publications and management plans for the Coldwater River. Regional fisheries management objectives relevant to tributaries in the Coldwater River Watershed may include:

- Steelhead Trout (*Oncorhynchus mykiss*), Thompson River and Chilcotin River populations in Canada, 2018: COSEWIC Technical summaries and supporting information for emergency assessments (COSEWIC 2018a)
- COSEWIC Assessment and Status Report on the Chinook Salmon (*Oncorhynchus tshawytscha*) in Canada (COSEWIC 2018b)
- COSEWIC assessment and status report on the Coho Salmon (*Oncorhynchus kisutch*) (Interior Fraser population) in Canada (COSEWIC 2016)
- Integrated Biological Status of Southern British Columbia Chinook Salmon (*Oncorhynchus tshawytscha*) under the Wild Salmon Policy (DFO 2016).
- Provincial Framework for Steelhead Management in BC (MFLNRO 2016)
- Canada’s Policy for Conservation of Wild Pacific Salmon (DFO 2005)
- Measures to protect fish and fish habitat (DFO 2020a)
- Integrated Fisheries Management Plan (June 1, 2018 – May 31, 2019) Salmon Southern BC (DFO 2020b)
- Freshwater Fisheries Program Plan (BC MOE 2007)

Existing fish and fish habitat data were obtained from previous assessments completed by Triton (Triton 2014; Filing ID A4H1Z2) and from Habitat Wizard and other electronic records compiled from the Fisheries Information Summary System and Consolidated Waterbody Surveys (BC MOE 2020). The Ecological Reports Catalogue (EcoCat) was also reviewed for the Coldwater River system (BC MOE 2014). Efforts were made to amalgamate existing 2013 or 2014 field data into the West Alternative studies, where possible (*i.e.*, where sites were previously investigated by a QEP).

The BC Conservation Data Centre (2020) and *Species at Risk Act* public registry (2020) were consulted to determine provincial and federal protections for any potentially listed species. Several guidelines and publications were also utilized in developing the standards and procedures for the field data collection program. These are listed in Table 1.1 of Technical Report 5C-7 in Volume 5C (Triton 2013, Filing ID A3S2C1).

All relevant information was recorded in the watercourse crossing inventory for the West Alternative, including known fish species presence and distribution, existing habitat features, provincial instream construction timing windows, and other site-specific characteristics (*e.g.,* migration barriers).

2.3 PERMITS AND CONDITIONS

Applications for Region 3 scientific fish collection permits were not approved for the TMEP (including the West Alternative) by the Ministry of Forests, Lands, Natural Resource Operations & Rural Development in 2019 and, consequently, no permit was applied for in 2020. Therefore, no fish sampling was conducted during the fall 2019 or summer 2020 fish and fish habitat assessments. However, it was not anticipated that any new fish-bearing watercourses (i.e., other than those with previously known fish records) would be encountered along the proposed West Alternative, and adequate historical information is available for the three watercourse crossings at Salem Creek and Coldwater River. In the event that a new potential fish habitat was to be encountered, the site would be flagged for future sampling (Note: no new potentially fish-bearing watercourse crossings were identified in the 2019 or 2020 field program).

2.4 FIELD ASSESSMENTS

A total of 49 watercourses were field investigated for the proposed pipeline corridor and access road network during the fall (October and November) 2019 and summer (July 7 – 8) 2020 programs. A lack of flow generally precluded the potential for sampling at any of the tributaries to the Coldwater during the fall and summer programs. In the absence of sampling, an evaluation of flow, gradient, habitat conditions and historical information was used to derive a sensitivity and classification for each watercourse or drainage. Where the potential for periods of frozen conditions and snow cover was encountered during the 2019 fall assessment, some of the watercourses (e.g., Lemoto and Oluk creeks), were subsequently investigated again during the Summer 2020 program.

Due to time limitations, four (4) of the proposed access road crossings were 'risk-managed' through desktop review and analysis of LiDAR imagery (*i.e.*, those sites indicated with an [RM] subscript in Appendix B). In these cases, the crossing was 'risk-managed' as fish or nonfish-bearing, based on professional judgement by a QEP, flow conditions and gradient within the study area, aerial imagery for the Project (LiDAR) and/or previously gathered fish data from a downstream watercourses or adjacent sites. If an RM crossing was believed to have potential connectivity to a fish-bearing watercourse downstream, it was assigned a default fish-bearing classification. However, if no defined channel could be observed from the LiDAR data, or if the watercourse drains directly into a nonfish-bearing watercourse, the RM crossing was defaulted to nonfish-bearing. Nonetheless, all defined watercourses (if present) will be field verified during final route walks or survey/engineering evaluations of access roads, including any final measurements of the stream channel and classification, as well as gradient and other site characteristics, where applicable. Detailed maps of the four (4) proposed RM road crossing sites are provided in Appendix E.

The field assessments were designed to meet current regulatory expectations and to address all issues related to fish and fish habitat. The sites were accessed by foot and/or four-wheel drive vehicles. Field data were collected by crews consisting of two Triton crew leads (QEPs) with fisheries and aquatics experience. During the summer 2020 program, the Triton crew was joined by five Indigenous technicians with related experience.

To fulfill the Project objectives, information obtained in the field included fish and fish habitat potential, fish species presence, fish distribution, locations of potential fish migration barriers, fish and fish habitat sensitivities, potential erosion/hydrologic concerns, and other physical parameters that affect fish and fish habitat potential. The field data were compiled and interpreted to determine stream classifications, sensitivity rankings, and navigability class at each potential watercourse crossing.

For detailed methodologies that were carried out during the July 2020 fish and fish habitat assessments, refer to the following sections of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C1):

- Stream Classification (Section 3.2.6);
- Fish Habitat Assessments (Section 3.2.7);
- Data Management (Section 3.2.9);
- Navigability (Section 3.3); and
- Fish and Fish Habitat Sensitivity (Section 3.4).

Detailed site assessments (including detailed riparian habitat and spawning habitat survey) were also conducted at the two proposed Coldwater River crossings.

The results obtained from the literature review and field investigations were used to develop construction recommendations, including proposed crossing methods, mitigation measures, (*e.g.,* fish salvage and/or water quality monitoring, or avoidance), and proposed least risk biological timing windows for each potential watercourse crossing. Results of the fall 2019 and summer 2020 fish and fish habitat assessments for the proposed West Alternative are presented in the following sections, as well as in the revised Watercourse Crossing Summary Tables (Appendices A and B) and fish- and nonfish-bearing atlases (Appendices C through E).

3.0 RESULTS OF HISTORICAL REVIEW

Detailed background information, historical fish distribution, and least risk biological windows for the Coldwater River are provided in in Section 4.2.3 of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C1). The following subsections summarize background information relevant to the 2019 and 2020 fish and fish habitat assessments for the West Alternative, including environmental setting and known fish species presence at each crossing. The background information guided several aspects of the aquatic effects assessment to determine fish habitat sensitivity (as described below and in Section 3.4 of Technical Report 5C-7 in Volume 5C).

Fish habitat sensitivity (high or low) were derived for each potential crossing based on the species present and the overall habitat potential rating (Table 3.5 of Technical Report 5C-7 in Volume 5C). Sensitivity ratings were established based on the species present or documented within a given system, flow regime (seasonal vs. perennial) and the available habitat for each life history stage of the key species present. This closely follows criteria defined by Fisheries and Oceans Canada (DFO) in the *Practitioners Guide to the Risk Management Framework* (DFO 2013a) and the Canadian Association of Petroleum Producers (CAPP) Pipeline Associated Watercourse Crossings, 3rd Edition (CAPP *et al.* 2005). A sensitivity ranking allows the use of a risk assessment approach to determine the overall risk to fishes and their habitat at a given watercourse crossing. The evaluation criteria and corresponding sensitivity rankings are presented in Table 3.5 of Technical Report 5C-7 in Volume 5C.

From the Sensitivity of Fish and Fish Habitat scores, regulators and the proponent can then determine the levels of risk associated with pipeline construction activities (Pathway of Effects) and methods/designs for pipeline and vehicle crossings for each proposed watercourse crossing. Once an appropriate construction method and construction timing has been selected, the associated impacts or Scale of Negative Effects can then be evaluated to define the Categories of Risk (*i.e.*, Significant Negative Effects, High Risk, Medium Risk and Low Risk). In some cases, the Scale of Negative Effects for a particular crossing cannot be fully determined until the Project is complete (*i.e.*, contingency open-cut crossing of sensitive fish habitat may be required where proposed horizontal directional drill [HDD], or Direct Pipe [DPI], or isolation is not feasible).

3.1 ENVIRONMENTAL SETTING AND FISH SPECIES DISTRIBUTION

The West Alternative is situated in the Lower Nicola River Watershed, beginning above KP 929.48 (SSEID005.19) just south of the City of Merritt. The proposed route parallels the south side of the Coldwater River for approximately 1.5 km before crossing the Coldwater River mainstem. It then turns upland (northwest) for approximately 4.5 km before turning back southwest and crossing the Coldwater a second time near Salem Creek. It then crosses the lower reach of Salem Creek and terminates at KP 946.85 (north of Kingsvale), where it would tie into the existing TMEP alignment.

3.1.1 Background Information and Existing Land Uses

The dominant biogeoclimatic (BGC) zones comprising the West Alternative study area are Interior Douglas-fir (xh1 – Okanagan Very Dry Hot), Ponderosa Pine (xh2 - Thompson Very Dry Hot), and Bunchgrass (xw1 - Nicola Very Dry Warm). These zones are characterized by generally dry conditions and can have a hot or cool climate depending on elevation and local site conditions. The Ponderosa Pine and Interior Douglas-fir zones consist of mosaics of forest and grassland, and fire is important for succession in this region (BC MOF 1998). Ponderosa Pine zones are generally drier and have a higher prevalence of alkaline ponds than Interior Douglas-fir zones. Bunchgrass Zones are extremely dry, and grasses form the dominant vegetation cover, as summer droughts are too severe for trees to become established (BC MOF 1998). Given the arid climate and limited rainfall, many streams have potential to dry up in these zones during the summer and fall months. Annual mean total precipitation for the region is 201-800 mm (NRC 2020).

Much of the West Alternative study area is comprised of flat or rolling hillsides with a south or east facing slopes and moderately steep gradient. Existing land uses include agriculture, livestock grazing, forestry, hunting and trapping, recreational fishing, hiking, cycling, camping, horseback riding, cross country skiing, and off-highway vehicle use. The nearest large residential area is the City of Merritt, to the northeast. Existing vehicle crossing structures occur along existing linear corridors and road grades. Irrigation withdrawals and the loss of riparian vegetation associated with ranching and agriculture have contributed to several water quality problems and impacts to salmon spawning and rearing in the Lower Nicola

Watershed (Millar *et al.* 1997). Other activities may affect the fish resources in the Lower Nicola River Watershed include logging in headwater regions, effluent loading from industrial activities, and mining (Millar *et al*. 1997).

3.1.2 Traditional Knowledge

Information on Indigenous practices related to fish and fish habitat in the Black Pines to Hope segment, which includes the West Alternative, are provided in Section 4.2.3 of Fisheries (BC) Technical Report 5C-7 in Volume 5C (Triton 2013; Filing ID A3S2C1). Results from any new or revised Traditional Land Use (TLU) studies, focusing specifically on the West Alternative, have not yet been reviewed or incorporated into the fisheries field studies.

3.1.3 Fish Species Distribution

The West Alternative extends approximately 19 km, roughly parallel to the Coldwater River (Lower Nicola River Watershed) and extending into surrounding upland areas. Known fish-bearing watercourses along the proposed alternative include the Coldwater River and Salem Creek (Table 3-1). Other tributaries to the Coldwater River along the proposed West Alternative have low potential for fish habitat due to steep slopes (dry upland areas) and seasonal/ephemeral flows.

The Coldwater River is the most important contributor of coho salmon, early run Chinook salmon, and steelhead in the Nicola River Watershed (LGL Ltd. 2007). Further information about the Coldwater River headwaters, drainage area, fish distribution, and contributions to salmon runs can be found in Section 4.2.3.2 (Coldwater River subsection) of Technical Report 5C-7 in Volume 5C (Triton December 2013, Filing ID A3S2C1).

Information about each indicator and listed species of concern, their distributions relative to the Project, and their Provincial Instream Work Windows by region is provided in Sections 4.3 through 4.5 of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C1). Indicator species that occur in the Coldwater River include coho salmon, chinook salmon, steelhead trout, rainbow trout, and bull trout/Dolly Varden. Other sport fish species include mountain whitefish.

Provincially or federally listed fish species include:

- Bull Trout (Blue-listed in BC [BC CDC 2020]),
- Interior Fraser River coho (‘Threatened’ under COSEWIC [COSEWIC 2016]), and
- Steelhead Trout, Thompson River population (Red-listed in BC and Endangered under COSEWIC, although not listed on Schedule 1 of SARA [COSEWIC 2018])

There are no species at risk or species at risk critical habitat known to occur in the Coldwater River or tributaries within the study area. Non-sportfish species in the Coldwater River include longnose dace, leopard dace, sucker species, sculpin species, redside shiner, and Pacific lamprey. Salem Creek (the other known fish-bearing watercourse that would be traversed by the West Alternative) has known presence of rainbow trout (Table 3-1)

TABLE 3-1

FISH SPECIES RECORDED PREVIOUSLY IN THE COLDWATER RIVER AND SALEM CREEK

Master Crossing Number	UTM	Watercourse Name	Known Fish Species Present[1]	Provincial Instream Work Window
CWGB-04a (DPI)	10 U 656768 E 5548321 N	Coldwater River	BT, CC, CH, CO, L, LDC, LNC, MW, PL, RB, RSC, ST, SU	July 22 – August 1
CWIRW-27	10 U 648884 E 5539576 N	Coldwater River	BT, CC, CH, CO, L, LDC, LNC, MW, PL, RB, RSC, ST, SU	July 22 – August 1
CWIRW-28	10 U 648916 E 5539363 N	Salem Creek	RB	July 22 – August 1

Notes: 1 Historical fish species were determined from Habitat Wizard (BC MOE 2020) and from previous fish and fish habitat assessments conducted on these watercourses (Triton 2014; Filing ID A4H1Z2)

4.0 RESULTS OF FIELD DATA COLLECTION

4.1 SUMMARY OF FISH-BEARING AND NONFISH-BEARING WATERCOURSES

New Crossings – Pipeline Corridor

In total, 28 potential watercourse crossings were investigated along the proposed West Alternative pipeline corridor in fall 2019 and summer 2020.

The following stream classifications were identified:

- 2 high sensitivity fish-bearing trenchless crossings of the Coldwater River, including CWGB-04a (proposed DPI) and CWIRW-27 (proposed HDD). The Coldwater River is a navigable waterway.
- 1 low sensitivity fish-bearing (S3) watercourse crossing (Salem Creek [CWIRW-28])
- 25 nonfish-bearing drainages (classified nonfish-bearing based on a lack of continuous defined channel and/or average gradient exceeding 25%):
    - 6 NCDs
    - 1 S6 (confirmed nonfish-bearing based on steep gradient downstream [>25%], marginal channel definition, dry/frozen conditions observed in October 2019, and minimal discharge observed in July 2020).
    - 18 NVCs

New Crossings – Access Roads

Another 21 potential watercourse crossings were investigated along proposed access roads for the West Alternative in summer 2020. The following stream classifications were identified through both desktop and field evaluations, including the 4 RM road crossings sites, as defined above in Section 2.4. Those include:

- 21 nonfish-bearing drainage (classified nonfish-bearing based on a lack of continuous defined channel)
    - 10 NCDs
    - 11 NVCs

Further summaries of the potential watercourse crossings identified along the West Alternative are presented in Table 4-1 through Table 4-4, and Figure 4-1 and Figure 4-2 below. Detailed results are presented in the revised Watercourse Crossing Summary Tables (Appendices A and B) and atlases (Appendices C through E).

TABLE 4-1

SUMMARY OF FIELD DATA COLLECTION FOR THE WEST ALTERNATIVE (PIPELINE)

Master Crossing Number	Watercourse Name	Sensitivity Ranking	Stream Classification	Known Fish Species Present	Provincial Instream Work Window	Least Risk Biological Window Proposed
CWGB-01	Unnamed Drainage	None	NVC	None	None	Open
CWGB-02	Unnamed Drainage	None	NVC	None	None	Open
CWGB-03	Unnamed Drainage	Low	NCD	None	None	Open
CWGB-04a (DPI)	Coldwater River	High	S1B	BT, CC, CH, CO, DV, L, LDC, LNC, MW, PL, RB, RSC, ST, SU	July 22 - August 01	July 22 - August 10[1]
CWGB-09	Unnamed Drainage	Low	NCD	None	None	Open
CWGB-10	Unnamed Drainage	None	NVC	None	None	Open
CWGB-11	Unnamed Drainage	Low	NCD	None	None	Open

Master Crossing Number	Watercourse Name	Sensitivity Ranking	Stream Classification	Known Fish Species Present	Provincial Instream Work Window	Least Risk Biological Window Proposed
CWGB-12	Unnamed Drainage	None	NVC	None	None	Open
CWGB-13	Unnamed Drainage	None	NVC	None	None	Open
CWGB-14	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-13	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-14	Unnamed Drainage	Low	NCD	None	None	Open
CWIRW-15	Lemoto Creek	Low	S6	None	None	Open
CWIRW-16	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-17	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-18	Oluk Creek	None	NVC	None	None	Open
CWIRW-19	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-20	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-21	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-22	Unnamed Drainage	Low	NCD	None	None	Open
CWIRW-23	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-24	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-25	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-26	Unnamed Drainage	None	NVC	None	None	Open
CWIRW-27	Coldwater River	High	S1B	BT, CC, CH, CO, DV, L, LDC, LNC, MW, PL, RB, RSC, ST, SU	July 22 - August 01	July 22 - August 10[1]
CWIRW-28	Salem Creek	Low	S3	RB	July 22 - October 31	Open
CWIRW-28a	Unnamed Drainage	Low	NCD	None	None	Open
CWIRW-29	Unnamed Drainage	None	NVC	None	None	Open

Note: [1] Should instream pipeline construction be required (*i.e.*, as a contingency measure), the timing will occur during low flow and inside or immediately adjacent to the LRBW. However, based on previous correspondence regarding instream construction timing for the Coldwater River, DFO has endorsed that, if required, infringement on the earlier side of the August 7-10 window is preferable (Jeff Guerin [DFO], Per. Comm., July 8, 2019)

TABLE 4-2

SUMMARY OF FIELD DATA COLLECTION FOR THE WEST ALTERNATIVE (ACCESS ROADS)

Master Crossing Number	Watercourse Name	Sensitivity Ranking	Stream Classification	Known Fish Species Present	Provincial Instream Work Window	Least Risk Biological Window Proposed
BCVA-CWA-01	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-02	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-03	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-04	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-05	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-06	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-08	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-09	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-10	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-11	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-12	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-13	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-14	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-15	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-16	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-17	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-18	Unnamed Drainage	None	NVC	None	None	Open
BCVA-CWA-19 (RM)	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-20 (RM)	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-21 (RM)	Unnamed Drainage	Low	NCD	None	None	Open
BCVA-CWA-22 (RM)	Unnamed Drainage	Low	NCD	None	None	Open

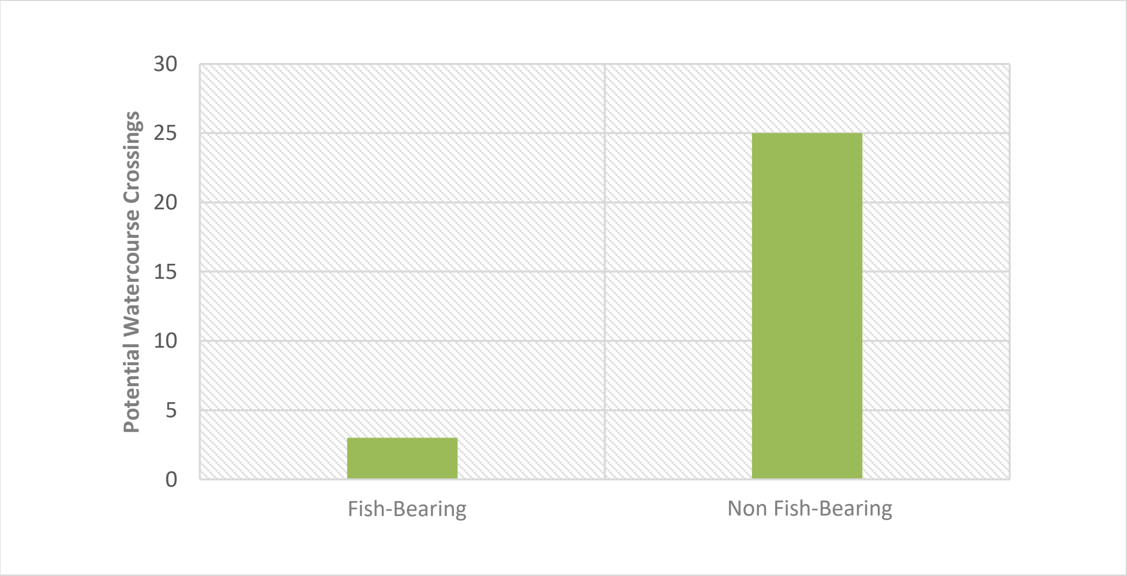


Figure 4-1 Fish-bearing status along the proposed West Alternative (pipeline)

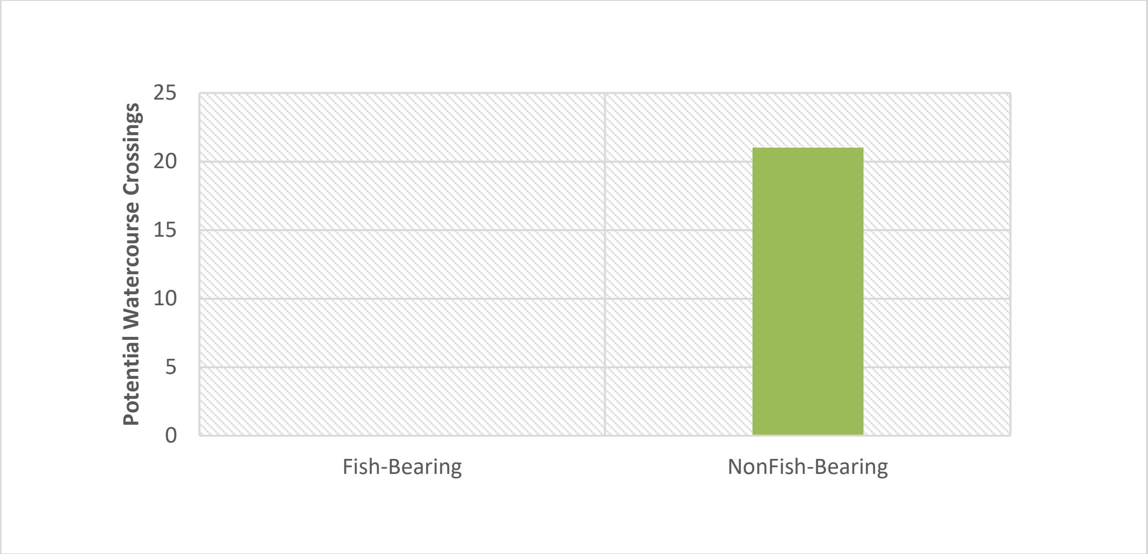


Figure 4-2 Fish-bearing status along the proposed West Alternative (access roads)

TABLE 4-3

SUMMARY OF STREAM CLASSIFICATIONS FOR CROSSINGS ALONG THE PROPOSED WEST ALTERNATIVE (PIPELINE)

Classification	Total Number
Fish-Bearing	
S1B (20–100 m)	2
S3 (1.5-5 m)	1
Nonfish-bearing	
Non-Classified Drainage (NCDs)	6
S6s (≤ 3 m)	1
No Visible Channel (NVCs)	18

TABLE 4-4

SUMMARY OF STREAM CLASSIFICATIONS FOR CROSSINGS ALONG THE PROPOSED WEST ALTERNATIVE (ACCESS ROADS)

Classification	Total Number
Nonfish-bearing	
Non-Classified Drainage (NCDs)	10
S6s (≤ 3 m)	0
No Visible Channel (NVCs)	11

4.2 NAVIGABLE OR POTENTIALLY NAVIGABLE WATERS

Table 4-5 summarizes the navigation classifications for watercourse crossings along the West Alternative. The Coldwater River is considered navigable and, therefore, would not be considered Minor Waters (for a definition of Minor Waters, refer to Section 1.6.2 of the Supplemental Fisheries [BC] Technical Report [Triton 2014, Filing ID A4H1Z2]). However, none of these watercourses are included in Transport Canada's (TC) List of Scheduled Waters and, therefore, do not require an application to TC. The remaining 26 potential watercourse crossings are either non-navigable or not applicable (i.e., no defined channel). All the potential watercourse crossings along the proposed access roads are not applicable (i.e., no defined channel; Table 4-6).

TABLE 4-5

NAVIGATION CLASSIFICATIONS AT POTENTIAL WATERCOURSE CROSSINGS ALONG THE WEST ALTERNATIVE (PIPELINE)

Classification	Total Number
None (drainages)	24
Class 1 Non-navigable	1
Class 2 Non-navigable	1
Class 3 Non-navigable	0
Potentially Navigable	0
Navigable	2

TABLE 4-6

NAVIGATION CLASSIFICATIONS AT POTENTIAL WATERCOURSE CROSSINGS ALONG THE WEST ALTERNATIVE (ACCESS ROADS)

Classification	Total Number
None (drainages)	21
Class 1 Non-navigable	0
Class 2 Non-navigable	0
Class 3 Non-navigable	0
Potentially Navigable	0
Navigable	0

5.0 RECOMMENDATIONS

5.1 GENERAL MITIGATION MEASURES

The following recommended mitigation for the reduction of potential effects is based on the current understanding of the *Fisheries Act* and applicable policies and acts that are currently being administered.

Section 7.0 of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C2) and Section 14.0 of the Project Environmental Protection Plan (EPP) provides Pathway of Effects and associated mitigation and reclamation measures related to fish and fish habitat for the entire TMEP. These measures include best management practices, general mitigation measures (e.g., sediment and erosion control and dewatering methods), a watercourse reclamation strategy, and post-construction monitoring. Trans Mountain has confirmed that the mitigation provided in Table 7.1 of Technical Report 5C-7 in Volume 5C (Triton December 2013; Filing ID A3S2C2) meet or exceed DFO's 2014 *Measures to Avoid Causing Harm to Fish and Fish Habitat*. It is understood that the 2014 DFO document is no longer in use and that, under the new *Fisheries Act* provisions, any works, undertakings, or activities in water that has potential for fish or connectivity to fish habitat, and that cannot meet all of DFO's *Measures to Protect Fish and Fish Habitat* (*e.g.*, avoidance of HADD; DFO 2020a) may require additional review by the CER/DFO. However, by following the proposed mitigations provided in Volume 5C in addition to the recommendations contained in this report, it is anticipated that all the potential watercourse crossings along the West Alternative will avoid HADD and death of fish.

It should be noted that Table 7.1 of Technical Report 5C-7 in Volume 5C refers to DFO Operational Statements specific to certain construction activity types (*e.g.*, High-Pressure Directional Drilling) and to the 2013 *Fisheries Protection Policy Statement.* Also, throughout Section 10.0 of the Supplemental Fisheries (BC) Technical Report (Triton 2014; Filing ID A4H1Z2), reference was made to DFO's 2014 *Measures to Avoid Causing Harm to Fish and Fish Habitat*. While these documents are no longer officially in use under the new provisions of the *Fisheries Act*, the general measures contained in these are still considered valid (and we understand DFO intends to bring back the Operational Statements at a future date). Furthermore, reference to specific DFO documents made within Table 7.1 of Technical Report 5C-7 of Volume 5C (*e.g.*, *Freshwater Intake End-of-Pipe Fish Screen Guideline*) should be replaced with newer Standards and Codes of Practice provided by DFO, where available. Newer guidance documents that should be used include, but may not be limited to the following:

- Measures to protect fish and fish habitat (*e.g.*, avoidance of HADD) (DFO 2020a)
- Fish and fish habitat protection policy statement (DFO 2020c)
- Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater (DFO 2020d)
- Interim code of practice: Temporary stream crossings (DFO 2020e)
- Interim code of practice: Culvert maintenance (DFO 2020f)

In addition to the Project's general mitigation measures, site-specific mitigation measures may also be required for fish-bearing watercourses (*i.e.*, Salem Creek and the Coldwater River). Site-specific mitigation measures to avoid causing HADD or death of fish are summarized in Section 5.3 below.

5.2 RECOMMENDED PIPELINE AND TEMPORARY VEHICLE AND EQUIPMENT CROSSING METHODS

Recommendations for potential pipeline and vehicle crossing methods considered the results from desktop analysis, field surveys, and industry experience. Habitat sensitivity (*i.e.,* high, or low), combined with the determination of fish-bearing status and the presence of sportfish, indicator species or other species of management concern were integral in the development of recommendations for proposed watercourse crossings methods. Descriptions of the different pipeline and vehicle crossing methods, and the decision-making process for determining the most suitable crossing methods are provided in Section 6.1 of Technical Report 5C-7 in Volume 5C (Triton December 2013, Filing ID A3S2C2).

Prior to construction, Trans Mountain will make an application for the appropriate provincial permits for crossings (including pipelines and access roads) of defined fish-bearing or nonfish-bearing watercourses (under the *Water Sustainability Act* [2014] - Section 11 *Changes In and About a Stream*, where a “stream” under the *Water Act* (1979) is defined as "a natural watercourse or source of water supply, whether usually containing water or not, ground water, and a lake, river, creek, spring, ravine, swamp and gulch”). Section 10 *use permits* for water withdrawal (under the Water Sustainability Act) and specific locations have not yet been fully evaluated on behalf of the Project but will follow federal and provincial guidelines and all conditions of the permit.

A request for review will be submitted to the CER/DFO where there may be potential for proposed construction to cause HADD or death of fish. There are no anticipated regulatory requirements associated with the *Fisheries Act* for nonfish-bearing watercourses (that lack connectivity to a fish-bearing watercourse), presuming the successful implementation of appropriate mitigation and reclamation measures during construction.

A trenched pipeline crossing method (i.e., isolation or open-cut) is recommended for 26 of the potential watercourse crossings that were investigated during the fall 2019 and summer 2020 fish and fish habitat assessments for the West Alternative, with the exception of the two Coldwater River crossings, where a trenchless method (i.e., primary HDD or DPI contingency is recommended). Fish salvage is recommended for Salem Creek (CWIRW-28), as well as water quality monitoring, if flowing at the time of construction. Water quality monitoring is also recommended for trenchless (HDD or DPI) crossings of the Coldwater River.

Apart from the two Coldwater River mainstem crossings, all other potential watercourse crossings along the West Alternative have an open least risk biological window (i.e., construction may proceed at any time). Similarly, construction may proceed at any time for a trenchless crossing of the Coldwater River (either HDD or DPI), as no instream works are proposed. However, if an alternative contingency isolated trenched or open-cut method is required (*i.e.*, if the primary proposed trenchless crossing methods at the Coldwater River crossings are not feasible, and micro tunnel is not feasible), a fish salvage and adherence to the least risk biological window (DFO endorsed window) proposed are recommended, along with a request for review by the CER/DFO (as per CER Condition 108 [Filing ID A92907]).

Where possible, existing vehicle crossing structures will be utilized for temporary vehicle/equipment crossings. However, where no existing crossing structures exist, a clear-span bridge, multi-span bridge, ramp and culvert, or other regulatory approved crossing method (depending on watercourse size and sensitivity at the proposed corridor) is recommended. Section 6.1 of Technical Report 5C-7 in Volume 5C provides general crossing recommendations and permitting requirements pertaining to fish-bearing and nonfish-bearing watercourses, temporary vehicle and equipment crossing methods, and pipeline and vehicle crossing methods at NCDs.

Use of a multi-span bridge will likely be required to string the DPI drag section at the Coldwater (CWGB-04a) crossing, which may require a possible support structure in the channel below the high-water mark. A DFO request for review will likely be required for use of a multi-span bridge, although there is expected to be low impacts to fish and fish habitat as support structures would be placed on dry portions of the river bed (i.e., side or mid-channel bars).

5.2.1 Summary of Recommended Pipeline and Access Crossing Methods

Table 5-1 to Table 5-3 summarize the pipeline and access road crossing recommendations for the potential watercourse crossings within the West Alternative.

TABLE 5-1

SUMMARY OF PROPOSED CONSTRUCTION METHODS AND HABITAT SENSITIVITY ALONG THE PROPOSED WEST ALTERNATIVE (PIPELINE)

Pipeline Construction Method	Sensitivity (Habitat)	Number Proposed	Master Crossing Numbers
Fish-Bearing			
Trenchless (DPI or HDD) with water quality monitoring	High	2	CWGB-4a (Coldwater River DPI) and CWIRW-27 (Coldwater River HDD)
Isolation with fish salvage and water quality monitoring, if flowing / Open-cut if dry or frozen to bottom	Low	1	CWIRW-28 (Salem Creek)
Nonfish-Bearing			
Isolation if water present / Open-cut if dry or frozen to bottom	Low	7	CWGB-03, CWGB-09, CWGB-11, CWIRW-14, CWIRW-15, CWIRW-22, CWIRW-28a
Open-cut	Low/None	18	CWGB-01, CWGB-02, CWGB-10, CWGB-12, CWGB-13, CWGB-14, CWIRW-13, CWIRW-16, CWIRW-17, CWIRW-18, CWIRW-19, CWIRW-20, CWIRW-21, CWIRW-23, CWIRW-24, CWIRW-25, CWIRW-26, CWIRW-29

TABLE 5-2

SUMMARY OF PROPOSED CONSTRUCTION METHODS AND HABITAT SENSITIVITY FOR TEMPORARY VEHICLE AND EQUIPMENT CROSSINGS ALONG THE PROPOSED WEST ALTERNATIVE (PIPELINE)

Vehicle/Equipment Crossing Method	Sensitivity (Habitat)	Number Proposed	Master Crossing Numbers
Fish-Bearing			
Clear-Span Bridge, Multi-Span Bridge or Access both banks	High	2	CWGB-4a (Coldwater River DPI) and CWIRW-27 (Coldwater River HDD)
Ramp and Culvert or Clear-Span Bridge or other regulatory approved crossing method	Low	1	CWIRW-28 (Salem Creek)
Nonfish-Bearing			
Regulatory approved crossing methods (*e.g.,* ramp and culvert, ford, swamp mat, snow/icefill)	Low	25	CWGB-01, CWGB-02, CWGB-03, CWGB-09, CWGB-10, CWGB-11, CWGB-12, CWGB-13, CWGB-14, CWIRW-13, CWIRW-14, CWIRW-15, CWIRW-16, CWIRW-17, CWIRW-18, CWIRW-19, CWIRW-20, CWIRW-21, CWIRW-22, CWIRW-23, CWIRW-24, CWIRW-25, CWIRW-26, CWIRW-28a, CWIRW-29

TABLE 5-3

SUMMARY OF PROPOSED CONSTRUCTION METHODS AND HABITAT SENSITIVITY ALONG THE PROPOSED WEST ALTERNATIVE (ACCESS ROADS)

Pipeline Construction Method	Sensitivity (Habitat)	Number Proposed	Master Crossing Numbers
Nonfish-Bearing			
Ramp and Culvert (or other regulatory approved crossing method)	Low	11	BCVA-CWA-01, BCVA-CWA-02, BCVA-CWA-03, BCVA-CWA-04, BCVA-CWA-05, BCVA-CWA-08, BCVA-CWA-14, BCVA-CWA-15, BCVA-CWA-16, BCVA-CWA-17, BCVA-CWA-18
Ford	Low/None	10	BCVA-CWA-06, BCVA-CWA-09, BCVA-CWA-10, BCVA-CWA-11, BCVA-CWA-12, BCVA-CWA-13, BCVA-CWA-19 (RM), BCVA-CWA-20 (RM), BCVA-CWA-21 (RM), BCVA-CWA-22 (RM)

5.3 SITE-SPECIFIC RECOMMENDATIONS

5.3.1 Fish-Bearing Watercourses

5.3.1.1 Salem Creek

Salem Creek has potential for rainbow trout. The proposed crossing method for Salem Creek (CWIRW-28) is an isolated trenched crossing with fish salvage and water quality monitoring if flowing, or an open-cut if dry or frozen to bottom. Although, instream works will be required at this crossing, no sensitive fish habitat will be disturbed, as Salem Creek has poor habitat conditions (*i.e.,* intermittent flow, high percentage of fine substrates, cattle disturbance, and lack of riparian vegetation and instream cover). Furthermore, conditions at the proposed crossing location are highly likely to be dry during construction (summer/fall). Following the trenched watercourse crossing of Salem Creek, Trans Mountain will reclaim instream and riparian habitat to pre-construction conditions.

5.3.1.2 Coldwater River

The Coldwater River has potential for steelhead trout, chinook salmon, coho salmon, rainbow trout, bull trout, and mountain whitefish. However, given that the primary proposed crossing method for the two Coldwater River crossing (CWGB-4a and CWIRW-27) is proposed as either a DPI or HDD, respectively, no instream works will be required. Therefore, no additional site-specific mitigation or instream or riparian habitat enhancement is recommended for the primary trenchless crossing methods. In the event that a secondary contingency isolated trenched or open-cut method is required, and depending on the construction timing, Trans Mountain will consult with the CER/DFO (as per CER Condition 108 [Filing ID A92907]) regarding approvals or authorizations and will determine the necessity for additional assessments (if required).

5.3.1.3 SARA-listed species

No SARA-listed species are known to occur within any watercourses crossed by the West Alternative or associated access roads, including the Coldwater River or its tributaries. As such, no site-specific mitigation measures to protect species at risk or critical habitat will be required for the West Alternative.

5.3.2 Nonfish-Bearing Watercourses and Drainages

The remaining 25 potential watercourse crossings traversed by the Coldwater West Alternative all have minimal aquatic connectivity to fish habitat and no fish habitat potential. Although, these crossings may contribute to recharge and food and nutrients during freshet, these crossings do not require any site-specific mitigations to prevent HADD or death of fish. Only general best management practices such as flow isolation if water is present at the time of construction, proper refueling and erosion and sediment control.

5.4 NAVIGABLE OR POTENTIALLY NAVIGABLE WATERS

Of the 28 potential watercourse crossings along the West Alternative, only the two Coldwater River crossings will have implication for navigable or potentially navigable waters. As such, appropriate mitigations contained in the Navigation and Navigation Safety section (Section 8.4.1 in Appendix G of the Project EPP) and measures set out in the Navigation and Navigation Safety Plan (CER Condition 48) will be implemented at these two crossings (i.e., for the primary HDD or contingency DPI, whichever is selected), including placement of warning signs indicating “construction ahead” up and downstream of all crossings of navigable waterbodies. However, the Coldwater River is not included in TC’s List of Scheduled Waters and, therefore, does not require an application to TC. The other 26 watercourses/drainages are non-navigable and are considered Minor Waters which, similarly, do not require an application to TC (*i.e.,* all are considered Class 1, Class 2, or ‘none’). Refer to Section 1.6.2 of the Supplemental Fisheries (BC) Technical Report (Triton 2014; Filing ID A4H1Z2) for regulatory updates to the *Navigation Protection Act* that were made in 2014.

6.0 PROJECT INTERACTIONS WITH FISH AND FISH HABITAT

Potential Project interactions (for construction and reclamation phases) with fish and fish habitat are outlined in Section 3.1.2 of the Fisheries (BC) Technical Report 5C-7 in Volume 5C (Triton 2013; Filing ID A3S2C1). Potential residual and cumulative effects of pipeline and facilities components of the Project on freshwater fisheries, including an evaluation of significance, are provided in Volume 5A Environmental and Socio-economic Assessment (ESA) – Biophysical Assessment (Triton December 2013; Filing IDs A3S1L2-A3S1R3). The proposed West Alternative is not expected to alter previous significance conclusions.

In general, riparian removal, temporary disturbance to instream habitat, temporary habitat fragmentation, fish salvages, and other construction activities all have the potential to cause direct or indirect mortality to fish and disturbance of fish habitat. However, the proposed crossing methods, construction timing, mitigation measures, and best management practices (as referenced in Section 5.0 above) will minimize the risk of Project-related impacts on fish and fish habitat. Overall, no negative impacts to fish or fish habitat (*i.e.,* no HADD or death of fish) are anticipated at any of the new potential watercourse crossings along the West Alternative, as associated with the primary and contingency crossing techniques proposed.

The primary proposed crossing method for the Coldwater River (CWIRW-4a) is a DPI with water quality monitoring, and the primary proposed crossing method for the Coldwater River (CWIRW-27) is an HDD with water quality monitoring (CWIRW-27). The proposed crossing method for Salem Creek (CWIRW-28) is an isolated trenched crossing with fish salvage and water quality monitoring, if flowing, or an open-cut if dry or frozen to bottom.

Trenchless crossings (*e.g.*, HDD and DPI) avoid work below the high-water mark and are designed to avoid impacts to fish and fish habitat, however, the use of a multi-span bridge to facilitate the DPI drag section at CWIRW-4, may include the installation of bridge footings below the high-water (i.e., on side bars). As such, pending the final bridge engineering design, a multi-span structure may trigger the need for further review by CER and DFO.

In the unlikely event of an accidental release of drilling mud, the ‘release or frac-out’ will be reported to the Environmental Inspector, who will halt construction activities and implement appropriate mitigations and reporting requirements as per the spill response plan of the Project EPP. Trenchless crossings may require vegetation clearing, but clearing will be set back to maintain a buffer appropriate to the watercourse classification. Clearing or disturbance of riparian vegetation and soils may also be required during maintenance activities (*e.g.*, integrity digs) and instream activities may disturb instream habitat during pipeline operations. Any future instream activities that may be required will undergo a separate impact assessment and regulatory review, if required.

The other 25 crossings along the West Alternative were confirmed in the field (by a QEP) to be low sensitivity, nonfish-bearing drainages. Those classified as NVC will be open-cut as they have no defined bed or banks and no surface connectivity to any watercourses downslope. For those classified as NCD, flow will be isolated if water is present at the time of construction. Therefore, the Project will have minimal interaction with fish or fish habitat at these nonfish-bearing crossings.

The 21 crossings along access roads for the West Alternative (includes 4 RM sites) were confirmed to be low sensitivity, nonfish-bearing drainages. Those classified as NVC can be crossed by ford as NVCs are not considered streams under the *Water Sustainability Act*. For those classified as NCD, a ramp and culvert or other regulatory approved crossing method is recommended (with flow isolation if water is present at the time of vehicle crossing construction).

7.0 SUMMARY

Triton conducted fish and fish habitat assessments at 49 potential watercourse crossings along the proposed West Alternative, including the proposed pipeline corridor (28 crossings) and access roads (21 crossings) in October and November 2019 and July 2020. The results of these assessments are summarized in Sections 3.0 and 4.0 and detailed in the revised Watercourse Crossing Summary Tables (Appendices A and B) and atlases (Appendix C through E) of this report. Recommendations and reference to mitigation measures (Section 5.0) are also provided for the new potential watercourse crossings along the proposed West Alternative. In total, one high sensitivity fish-bearing watercourse (includes two trenchless crossings of the Coldwater River) and one low sensitivity fish-bearing watercourse (Salem Creek) will be crossed by the proposed route. The remaining 25 pipeline crossings are nonfish-bearing channels (S6), 'non-classified drainages' (NCD), or have 'no visible channel' (NVC). The two Coldwater River locations will be crossed using a trenchless (HDD or DPI) method (with water quality monitoring) and vehicle/equipment will access these crossings from both banks, thereby requiring no instream works. Salem Creek is an intermittent, low sensitivity fish-bearing watercourse and will be crossed via an isolated trenched (including fish salvage and water quality monitoring, if flowing) or open-cut (if dry or frozen) method. Overall, no HADD or death of fish is anticipated at any of the potential primary or contingency watercourse crossing methods proposed along the West Alternative.

This report presents updates to the Watercourse Crossing Inventory (NEB Condition 43), last filed to the CER in July 2019, that would be required if the West Alternative should become the preferred TMEP alignment. Significance conclusions for fish and fish habitat along the previously proposed TMEP alignment were reported in the Fisheries (British Columbia) Technical Report (Report 5C-7 in Volume 5C, Triton Environmental Consultants [Triton] 2013; Filing ID A3S2C1-A3S2G5) and the Supplemental Fisheries (British Columbia) Technical Report (Triton 2014; Filing ID A4H1Z2).

8.0 REFERENCES

BC Conservation Data Centre. 2020. BC Species and Ecosystems Explorer. B.C. Ministry of Environment. Victoria, BC. [Accessed July 2020]. Available from: http://a100.gov.bc.ca/pub/eswp/.

BC Ministry of Environment. 2020. Fisheries Inventory: Fisheries Information Summary System, Consolidated Waterbody Surveys, Habitat Wizard, and EcoCat. [Accessed July 2020]. Available from: http://env.gov.bc.ca/fish/fiss/index.html.

BC Ministry of Environment. 2014. Fisheries Inventory: Fisheries Information Summary System, Consolidated Waterbody Surveys, Habitat Wizard, and EcoCat. Website: http://env.gov.bc.ca/fish/fiss/index.html. Last accessed: October 2014.

BC Ministry of Environment. 2007. Freshwater Fisheries Program Plan. [Accessed August 2020]. Available from: http://www.env.gov.bc.ca/fw/docs/fisheries_program_plan.pdf.

BC Ministry of Forests 1998. Biogeoclimatic Zones of British Columbia. [Accessed October 2019]. Available from: http://www.for.gov.bc.ca/hfd/library/documents/treebook/biogeo/biogeo.htm.

Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association. 2005. Pipeline Associated Watercourse Crossings. Prepared by TERA Environmental Consultants and Salmo Consulting Inc. Calgary, AB.

Canada Energy Regulator. 2019. Filing Manual – Guide A – Facilities Applications. Chapter 4 – Physical Projects. Guide A.2 – Environmental and Socio-Economic Assessment. [Accessed October 2019]. Available from: https://www.cer-rec.gc.ca/bts/ctrg/gnnb/flngmnl/index-eng.html.

COSEWIC. 2018a. Technical Summaries and Supporting Information or Emergency Assessments, Steelhead Trout (Onchorynchus mykiss) (Thompson River and Chilcotin River populations). Committee on the Status of Endangered Wildlife in Canada. Ottawa. 26 pp.

COSEWIC. 2018b. COSEWIC assessment and status report on the Chinook Salmon Oncorhynchus tshawytscha, Designatable Units in Southern British Columbia (Part One – Designatable Units with no or low levels of artificial releases in the last 12 years), in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxxi + 283 pp. (http://www.registrelepsararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

COSEWIC. 2012. COSEWIC assessment and status report on the Bull Trout Salvelinus confluentus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. iv + 103 pp. Available from: www.registrelep-sararegistry.gc.ca/default_e.cfm.

COSEWIC. 2016. COSEWIC assessment and status report on the Coho Salmon Oncorhynchus kisutch, Interior Fraser population, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 50 pp. Available from: http://www.registrelep-sararegistry.gc.ca/ default.asp?lang=en&n =24F7211B-1).

Fisheries and Oceans Canada. 2005. Canada's Policy for Conservation of Wild Pacific Salmon. [Accessed July 2020]. Available at: https://www.pac.dfo-mpo.gc.ca/fm-gp/salmon-saumon/wsp-pss/policy-politique/intro-eng.html.

Fisheries and Oceans Canada. 2013. Practitioners Guide to the Risk Management Framework for DFO Habitat Management Staff – Version 1.0. Habitat Management Program, Fisheries and Oceans Canada. 26 pp.

Fisheries and Oceans Canada. 2016. Integrated Biological Status of Southern British Columbia Chinook Salmon (Oncorhynchus tshawytscha) Under the Wild Salmon Policy. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/042.

Fisheries and Oceans Canada. 2020a. Measures to protect fish and fish habitat. [Accessed July 2020]. Available at: https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html.

Fisheries and Oceans Canada. 2020b. Integrated Fisheries Management Plan (JUNE 1, 2020 - MAY 31, 2021) Salmon Southern BC. [Accessed August 2020]. Available at: https://waves-vagues.dfo-mpo.gc.ca/Library/40881404.pdf.

Fisheries and Oceans Canada. 2020c. Fish and Fish Habitat Protection Policy Statement. [Accessed July 2020]. Available from: http://www.dfo-mpo.gc.ca/pnw-ppe/policy-politique-eng.pdf.

Fisheries and Oceans Canada. 2020d. Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater. [Accessed July 2020]. Available at: https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html.

Fisheries and Oceans Canada. 2020e. Interim code of practice: Temporary stream crossings. [Accessed July 2020]. Available at: https://www.dfo-mpo.gc.ca/pnw-ppe/codes/temporary-crossings-traversees-temporaires-eng.html.

Fisheries and Oceans Canada. 2020f. Interim code of practice: Culvert maintenance. [Accessed October 2020]. Available at: https://www.dfo-mpo.gc.ca/pnw-ppe/codes/culvert-maintenance-entretien-ponceaux-eng.html.

Guerin, J. 2019. Email correspondence with lead authority (Jeff Guerin, DFO Biologist). July 8, 2019.

LGL Ltd. Environmental Research Associates, Diversified Ova Tech Ltd., and Nicola Watershed Stewardship and Fisheries Authority. 2007. Development of an Annual Salmonid Productivity Assessment Program for the Nicola River Watershed. Prepared by Mathews, M., B. Bocking, G. Glova, N. Todd, and T. Sampson, on behalf of the Nicola Tribal Association. Prepared for the Pacific Salmon Foundation. 30 pp.

Millar, J., M. Child and N. Page. 1997. Nicola River Watershed: Fisheries Resource Issues and the Involvement of DFO, MELP and First Nations. Department of Fisheries and Oceans, Fraser River Action Plan.

Ministry of Forests, Lands and Natural Resource Operations. 2016. Provincial Steelhead Management Framework. Ministry of Forests, Lands and Natural Resource Operations Fish and Wildlife Branch, Victoria, B.C. April 2016. 36 pp. Species at Risk Public Registry. 2020. Government of Canada. [Accessed July 2020]. Available from: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html.

TERA Environmental Consultants. December 2013. Volume 5A of the Environmental and Socio-Economic Assessment (ESA) – Biophysical of the Trans Mountain Pipeline ULC Trans Mountain Expansion Project. Calgary, AB.

Triton Environmental Consultants Ltd. 2013. Technical Report 5C-7 in Volume 5C, Fisheries (British Columbia) Technical Report of the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, December 2013. Filing ID A3S2C1-A3S2G5.

Triton Environmental Consultants Ltd. 2014. Supplemental Fisheries (British Columbia) Technical Report for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project, December 2014. Filing ID A4H1Z2-A4H1Z7.

8.1 GIS DATA AND MAPPING REFERENCES

This subsection includes references cited on the figures accompanying this report.

Natural Resources Canada, Centre for Topographic Information. 2020. CanMatrix (Georeferenced) Digital Topographic Maps of Canada 50k (digital file). Sherbrooke, QC. [Accessed August 2020]. Available from: http://geogratis.gc.ca/geogratis/search?lang=en.

APPENDIX A

WATERCOURSE CROSSING SUMMARY TABLE FOR THE WEST ALTERNATIVE

Pipeline

					UTM Coordinates (NAD 83)									Riparian Habitat Composition & Functionality				Pipeline Crossing Method		Vehicle Crossing Method					
Watercourse Crossing ID	AK	Watercourse Name	Flow Regime	Class	Zone	Easting	Northing	Fish Spp. Captured or Observed (Previously Documented)	Sensitivity Rating	Instream Work Window (MoE and DFO)	Least Risk Biological Window (LRBW) Proposed	Rationale to Support LRBW Proposed if Different from Provincial Work Window	Planned Instream Construction Timing	Riparian Habitat Function Ranking (L, M, H)	Type	Stage	Apparent Condition	Recommended Primary	Recommended Contingency	Project Proposed Primary	Navigability Status	Site-Specific Comments	Reclamation	Can all of DFO's Measures to Avoid HADD be implemented for the Primary Pipeline Method?	Riparian Buffer (m)
CWGB-01	0.04	Unnamed Drainage	n/a	NVC	10	658010	5548513	None	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	-	Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWGB-02	0.0	Unnamed Drainage	n/a	NVC	10	657229	5548350	None	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	-	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWGB-03	1.33	Unnamed Drainage	seasonal	NCD	10	656821	5548399	None (None)	Low	None	Open	N/A	Summer/Fall	-	-	-	-	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	(None)	Seasonal drainage with extensive scour but no continuous defined channel; dry at time of assessment (July 2020) but may contain overflow water from the Clearwater River during flood conditions; no fish habitat potential.	A or B	Yes	0
CWGB-04a	1.4	Coldwater River	Perennial	S1B	10	656768	5548321	CH, CO (BT, CC, CH, CO, DV, L, LDC, LNC, MW, PL, RB, RSC, ST, SU)	High	July 22 - August 1	July 22 - August 10	If instream construction is required, DFO has endorsed that infringement on the earlier side of the August 7-10 window is preferred.[1] Early-run CH spawn in the upper Coldwater, above Kingsvale, from August 15 – 30, and should be finished migration by mid-July. Late-run CH, migrate throughout August, but spawn mostly in the Lower Coldwater, below Kingsvale, to the confluence with Nicola River (from September 7 – 30).[1] CO spawn from late October to December, throughout the Coldwater River, but most heavily upstream from Juliet Creek, whereas ST spawn in the spring (i.e., May to June), primarily downstream from Brodie.[2] Key emergence periods for CH, CO and ST are approximately late April to early-May and mid to late-July, respectively.2	Anytime - Trenchless	Moderate	D	PS	Patchy	DPI with water quality monitoring	Micro-tunneling with water quality monitoring	Clear-Span Bridge or access both banks	Navigable	This location is the DPI crossing of the Coldwater River. Moderate to high potential for salmonids (e.g., CH, ST, CO and BT); abundant cover and high instream complexity for rearing; moderate to high overwintering is attributed to occasional deep pools and perennial flow; moderate to high potential for spawning, although limited in sections with high percentages of large cobble and boulder; water quality monitoring is recommended for both trenched and trenchless options. If instream construction is required, DFO has endorsed that infringement on the earlier side of the August 7-10 window is preferred.	Comply with Federal and Provincial Regulations	Yes	50
CWGB-09	3.08	Unnamed Drainage	Seasonal	NCD	10	655266	5548582	None (None)	Low	None	Open	N/A	Summer/Fall	-	-	-	-	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	(None)	Seasonal drainage with short sections of scour and overland flow (i.e., evidence of hydrophilic vegetation), although dry at the time of assessment (October 2019); no continuous defined channel greater than 100 m; no fish habitat potential.	A or B	Yes	0
CWGB-10	3.25	Unnamed Drainage	-	NVC	10	655100	5548602	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWGB-11	3.49	Unnamed Drainage	Seasonal	NCD	10	654863	5548629	None (None)	Low	None	Open	N/A	Summer/Fall	-	-	-	-	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	(None)	Seasonal drainage with overland flow and pockets of standing water; frozen to bottom at time of assessment (October 2019); no continuous defined channel greater than 100 m; no fish habitat potential.	A or B	Yes	0

					UTM Coordinates (NAD 83)									Riparian Habitat Composition & Functionality				Pipeline Crossing Method		Vehicle Crossing Method					
Watercourse Crossing ID	AK	Watercourse Name	Flow Regime	Class	Zone	Easting	Northing	Fish Spp. Captured or Observed (Previously Documented)	Sensitivity Rating	Instream Work Window (MoE and DFO)	Least Risk Biological Window (LRBW) Proposed	Rationale to Support LRBW Proposed if Different from Provincial Work Window	Planned Instream Construction Timing	Riparian Habitat Function Ranking (L, M, H)	Type	Stage	Apparent Condition	Recommended Primary	Recommended Contingency	Project Proposed Primary	Navigability Status	Site-Specific Comments	Reclamation	Can all of DFO's Measures to Avoid HADD be implemented for the Primary Pipeline Method?	Riparian Buffer (m)
CWGB-12	3.55	Unnamed Drainage	-	NVC	10	654820	5548635	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWGB-13	4.16	Unnamed Drainage	-	NVC	10	654191	5548708	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWGB-14	4.50	Unnamed Drainage	-	NVC	10	653862	5548769	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated swale; no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-13	4.97	Unnamed Drainage	-	NVC	10	653488	5549043	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-14	5.26	Unnamed Drainage	Seasonal	NCD	10	653243	5549089	None (None)	Low	None	Open	N/A	Summer/Fall	-	-	-	-	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	(None)	Seasonal drainage with dense vegetation (Red-osier Dogwood) at the centre of the PPC; dry at time of assessment (October 2019); short sections of scour, but no continuous defined channel greater than 100 m; no fish habitat potential.	A or B	Yes	0
CWIRW-15	5.37	Lemoto Creek	Seasonal	S6	10	653121	5549057	None (None)	Low	None	Open	N/A	Summer/Fall	-	-	-	-	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	Class 1 Non-Navigable	Small, marginally defined watercourse (upper headwaters of Lemoto Creek); mostly dry in October 2019 and minimal discharge observed in July 2020; no fish habitat potential, gradient barriers downslope (>25%).	B or C	Yes	10
CWIRW-16	6.07	Unnamed Drainage	-	NVC	10	652520	5548764	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated swale (shallow draw situated within open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-17	6.94	Unnamed Drainage	-	NVC	10	651879	5548296	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated swale (small draw with dense Red-Osier Dogwood and Alder); slight soil saturation, but no defined channel or evidence of fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-18	8.73	Oluk Creek	-	NVC	10	650846	5547075	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; crossing is located at the upslope end of the mapped feature (Oluk Creek); no fish habitat potential.	A	Yes	0
CWIRW-19	9.13	Unnamed Drainage	-	NVC	10	650705	5546686	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-20	9.58	Unnamed Drainage	-	NVC	10	650608	5546262	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-21	9.83	Unnamed Drainage	-	NVC	10	650557	5546006	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0

Watercourse Crossing ID	AK	Watercourse Name	Flow Regime	Class	UTM Coordinates (NAD 83)			Fish Spp. Captured or Observed (Previously Documented)	Sensitivity Rating	Instream Work Window (MoE and DFO)	Least Risk Biological Window (LRBW) Proposed	Rationale to Support LRBW Proposed if Different from Provincial Work Window	Planned Instream Construction Timing	Riparian Habitat Composition & Functionality				Pipeline Crossing Method		Vehicle Crossing Method	Navigability Status	Site-Specific Comments	Reclamation	Can all of DFO's Measures to Avoid HADD be implemented for the Primary Pipeline Method?	Riparian Buffer (m)
					Zone	Easting	Northing							Riparian Habitat Function Ranking (L, M, H)	Type	Stage	Apparent Condition	Recommended Primary	Recommended Contingency	Project Proposed Primary					
CWIRW-22	10.86	Unnamed Drainage	Seasonal	NCD	10	650295	5545084	None (None)	Low	None	Open	N/A	Summer/Fall	-	-	-	-	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	(None)	Seasonal drainage with short sections of scour and overland flow, but no continuous defined channel greater than 100 m; densely vegetated (Red-Osier Dogwood) at centre of the PPC; no fish habitat potential.	A or B	Yes	0
CWIRW-23	11.05	Unnamed Drainage	-	NVC	10	650225	5544906	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated swale (dense Red-Osier Dogwood); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-24	13.43	Unnamed Drainage	-	NVC	10	649805	5542632	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated swale (sparse Red-Osier Dogwood and Alder); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-25	13.94	Unnamed Drainage	-	NVC	10	649665	5542146	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated hillside (open forest and grassland) with no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-26	14.95	Unnamed Drainage	-	NVC	10	649414	5541164	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Vegetated swale with no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
CWIRW-27	16.70	Coldwater River	Perennial	S1B	10	648884	5539576	CH, CO (BT, CC, CH, CO, DV, L, LDC, LNC, MW, PL, RB, RSC, ST, SU)	High	July 22 - August 1	July 22 - August 10	If instream construction is required, DFO has endorsed that infringement on the earlier side of the August 7-10 window is preferred.[1] Early-run CH spawn in the upper Coldwater, above Kingsvale, from August 15 – 30, and should be finished migration by mid-July. Late-run CH, migrate throughout August, but spawn mostly in the Lower Coldwater, below Kingsvale, to the confluence with Nicola River (from September 7 – 30).[1] CO spawn from late October to December, throughout the Coldwater River, but most heavily upstream from Juliet Creek, whereas ST spawn in the spring (i.e., May to June), primarily downstream from Brodie.[2] Key emergence periods for CH, CO and ST are approximately late April to early-May and mid to late-July, respectively.[2]	Anytime - Trenchless	Moderate	D	PS	Patchy	HDD with water quality monitoring	Isolation with fish salvage during low flow or open-cut inside DFO endorsed timing window; water quality monitoring required	Clear-Span Bridge or access both banks	Navigable	Moderate to high potential for salmonids (e.g., CH, ST, CO and BT); abundant cover and high instream complexity for rearing; moderate to high overwintering (occasional deep pools and perennial flow); moderate potential for spawning (areas of suitable gravel substrate, although limited by high percentages of large cobble and boulders with moderate embeddedness); water quality monitoring is recommended for both trenched and trenchless options. If instream construction is required, DFO has endorsed that infringement on the earlier side of the August 7-10 window is preferred.	Comply with Federal and Provincial Regulations	Yes	50

Watercourse Crossing ID	AK	Watercourse Name	Flow Regime	Class	UTM Coordinates (NAD 83)			Fish Spp. Captured or Observed (Previously Documented)	Sensitivity Rating	Instream Work Window (MoE and DFO)	Least Risk Biological Window (LRBW) Proposed	Rationale to Support LRBW Proposed if Different from Provincial Work Window	Planned Instream Construction Timing	Riparian Habitat Composition & Functionality				Pipeline Crossing Method		Vehicle Crossing Method	Navigability Status	Site-Specific Comments	Reclamation	Can all of DFO's Measures to Avoid HADD be implemented for the Primary Pipeline Method?	Riparian Buffer (m)
					Zone	Easting	Northing							Riparian Habitat Function Ranking (L, M, H)	Type	Stage	Apparent Condition	Recommended Primary	Recommended Contingency	Project Proposed Primary					
CWIRW-28	16.92	Salem Creek	Intermittent	S3	10	648916	5539363	RB (None)	Low	July 22 - October 31	Open	Minimal potential for spawning (channel is highly disturbed with high percentages of fines); seasonal migration only; construction can proceed anytime using standard mitigation measures.	Summer/Fall	Low	-	NA	Open	Isolation with fish salvage and water quality monitoring if flowing / Open-cut if dry or frozen to bottom	-	Ramp and Culvert or Clear-Span Bridge	Class 2 Non-Navigable	Dry/Intermittent watercourse with low fish habitat potential; one juvenile RB was captured downstream from Coldwater Road in May 2013; however, potential for fish presence is limited to spring flow conditions, as channel is dry for much of the year (dry in October 2012 and November 2019); rearing potential is limited by high disturbance (i.e., cattle grazing), lack of year-round flow, and absence of cover throughout the ZOI; dry winter conditions preclude overwintering; disturbed channel bed, high fines, and lack of flow limit potential for spawning; migration is limited by poor channel definition downstream from the PPC.	D or E	Yes	20
CWIRW-28a	17.01	Unnamed Drainage	Seasonal	NCD	10	648929	5539276	None (None)	Low	None	Open	NA	Summer/Fall	-	-	-	Open	Isolation if water present / Open-cut if dry or frozen to bottom	-	Ramp and Culvert	(None)	Small drainage through agricultural field that may convey seasonal overland flow; sections of scour observed, but no defined bed or banks; no fish habitat potential; two culverts located underneath the Kettle Valley Rail Trail were observed to be in poor condition.	A or B	Yes	0
CWIRW-29	17.43	Unnamed Drainage	-	NVC	10	648855	5538872	None (None)	None	None	Open	N/A	Summer/Fall	-	-	-	-	Open-cut	-	Ford	(None)	Agricultural field with no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0

APPENDIX B

WATERCOURSE CROSSING SUMMARY TABLE FOR THE WEST ALTERNATIVE

Access

Watercourse Crossing ID	Watercourse Name	Flow Regime	Class	UTM Coordinates (NAD 83)			Fish Spp. Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window (MoE and DFO)	Least Risk Biological Window (LRBW) Proposed	Rationale to Support LRWB Proposed if Different from Provincial Work Window	Planned Instream Construction Timing	Vehicle Crossing Method	Navigability Status	Site-Specific Comments	Reclamation	Can all of DFO's Measures to Avoid HADD be implemented for the Primary Pipeline Method?	Riparian Buffer (m)
				Zone	Easting	Northing							Project Proposed Primary					
BCVA-CWA-01	Unnamed drainage	-	NVC	10	658037	5548496	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-02	Unnamed Drainage	-	NVC	10	657956	5548173	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-03	Unnamed Drainage	-	NVC	10	657603	5547829	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-04	Unnamed Drainage	-	NVC	10	657459	5547718	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-05	Unnamed Drainage	-	NVC	10	657435	5547699	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-06	Unnamed Drainage	Seasonal	NCD	10	657318	5547588	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	Vegetated swale with areas of groundwater seepage; no continuous defined channel; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-08	Unnamed Drainage	-	NVC	10	655100	5548602	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-09	Unnamed Drainage	Seasonal	NCD	10	651409	5548328	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	Vegetated swale with areas of groundwater seepage; no continuous defined channel; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-10	Unnamed Drainage	Seasonal	NCD	10	651141	5547734	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	Vegetated swale with areas of groundwater seepage; no continuous defined channel; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-11	Unnamed Drainage	Seasonal	NCD	10	650467	5546184	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	Vegetated swale with sections of groundwater seepage and overland flow; no continuous defined channel; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-12	Unnamed Drainage	Seasonal	NCD	10	650466	5546185	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	Vegetated swale with areas of groundwater seepage and overland flows; no continuous defined channel, areas of scour up to 10m long; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-13	Unnamed Drainage	Seasonal	NCD	10	650211	5545327	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	Vegetated swale with sections of scour, groundwater seepage, and overland flow; no continuous defined channel, no fish habitat potential.	A or B	Yes	0
BCVA-CWA-14	Unnamed Drainage	-	NVC	10	650195	5544913	None (None)	None	None	Open	N/A	Summer/Fall	Ford	-	Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-15	Unnamed Drainage	-	NVC	10	649576	5543218	None (None)	None	None	Open	N/A	Summer/Fall	Ford	(None)	Vegetated swale (sparse Red-Osier Dogwood and Alder); no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-16	Unnamed Drainage	-	NVC	10	649424	5542503	None (None)	None	None	Open	N/A	Summer/Fall	Ford	(None)	Vegetated hillside (open forest and grassland) with no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-17	Unnamed Drainage	-	NVC	10	649137	5541548	None (None)	None	None	Open	N/A	Summer/Fall	Ford	(None)	Vegetated swale with no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-18	Unnamed Drainage	-	NVC	10	649071	5541665	None (None)	None	None	Open	N/A	Summer/Fall	Ford	(None)	Vegetated swale with no defined channel or evidence of water or fluvial processes; no fish habitat potential.	A	Yes	0
BCVA-CWA-19 (RM)	Unnamed Drainage	Seasonal	NCD	10	648183	5540042	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-20 (RM)	Unnamed Drainage	Seasonal	NCD	10	647954	5539941	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential.	A or B	Yes	0

Watercourse Crossing ID	Watercourse Name	Flow Regime	Class	UTM Coordinates (NAD 83)			Fish Spp. Captured or Observed (Previously Documented)	Sensitivity Rating	Provincial Instream Work Window (MoE and DFO)	Least Risk Biological Window (LRBW) Proposed	Rationale to Support LRWB Proposed if Different from Provincial Work Window	Planned Instream Construction Timing	Vehicle Crossing Method	Navigability Status	Site-Specific Comments	Reclamation	Can all of DFO's Measures to Avoid HADD be implemented for the Primary Pipeline Method?	Riparian Buffer (m)
				Zone	Easting	Northing							Project Proposed Primary					
BCVA-CWA-21 (RM)	Unnamed Drainage	Seasonal	NCD	10	648557	5539587	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential.	A or B	Yes	0
BCVA-CWA-22 (RM)	Unnamed Drainage	Seasonal	NCD	10	648140	5539258	None (None)	Low	None	Open	N/A	Summer/Fall	Ramp and Culvert	(None)	No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential.	A or B	Yes	0

APPENDIX C

FISH-BEARING ATLAS FOR THE WEST ALTERNATIVE
Pipeline


View upstream at 125 m upstream from the PPC (07-07-20)


View downstream at 125 m upstream from the PPC (07-07-20)


View of left bank approach at 125 m upstream from the PPC (07-07-20)


View of right bank approach at 125 m upstream from the PPC (07-07-20)

Channel Morphology

Pattern: Irregular Meandering
Confinement: Frequently Confined
Bank Shape LB: Vertical
RB: Sloping
Habitat Unit at ROW: Riffle
Habitat Unit through ZOI: Riffle-Run
Gradient (%): 4
Main Stem: Coldwater River

	Mean (m)	Range (m)
Wetted Width:	24.8	19.0 – 31.0
Channel Width:	30.8	28.0 – 37.0
Bank Height:	9.47	0.50 – 80.00
Res. Pool Depth:	0.33	0.15 – 0.50

Water Quality/Quantity

Water Temperature (°C): 13.0
Conductivity (µS/cm): 122.0
pH: 8.40
D. Oxygen (mg/L): -
Discharge (m^3/s): 9.42
Flow Regime: Perennial
Turbidity: Clear

Substrate (*ROW*)

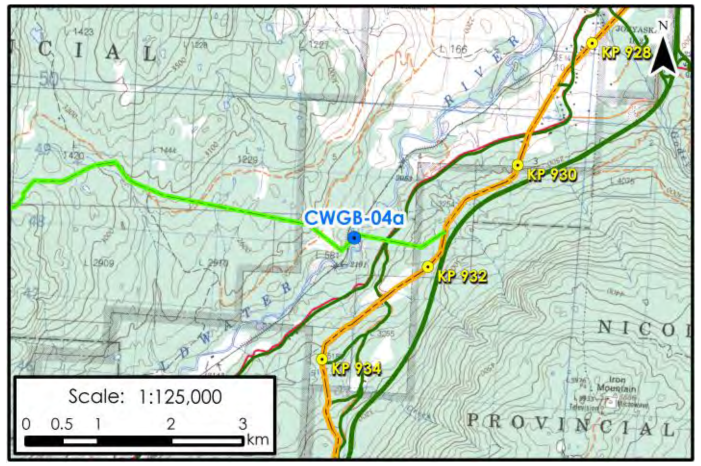
Organics:	0
Fines:	5
Sml Gravel:	5
Lrg Gravel:	60
Sml Cobble:	20
Lrg Cobble:	10
Boulder:	0
Bedrock:	0

Cover

Dominant: Boulder
Subdominant: OHV

Riparian

Type: Shrub/Deciduous
Maturity: Shrub/PS
Crown Closure: 1-20%



Source: NRC, Centre for Topographical Information. 2013 (1:125,000)

Provincial Window of Least Risk:
July 22 – August 1

Least Risk Biological Window Proposed:
July 22 – August 10

Construction Timing:
Anytime – Trenchless

Stream Classification BC: S1B
Navigability: Navigable
Reason for Decision: Width >5 m
Barriers to Fish Movement: No

Fish Presence and Life History Stage

Species	YOY	Juv	Adult	Unknown
-	-	-	-	-

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
BT/DV	M-H	M-H	M-H	M-H
CO	M-H	M-H	M-H	M-H
CH	M-H	M-H	M-H	M-H
MW	M-H	M-H	M-H	M-H
RB/ST	M-H	M-H	M-H	M-H

Sampling Effort

Method	Time	Distance	Date
-	-	-	-

Recommended Primary Pipeline Crossing Method:
DPI with water quality monitoring

Recommended Contingency Pipeline Crossing Method:
Microtunneling with water quality monitoring

Recommended Vehicle Crossing Method (Non-Frozen):
Multi-Span Bridge or access both banks

Recommended Vehicle Crossing Method (Dry/Frozen):
Multi-Span Bridge or access both banks

Historical Fish Presence:
BT, CC, CH, CO, DV, L, LDC, LNC, MW, PL, RB, RSC, ST, SU

Comments:
Moderate to high potential for salmonids (e.g., CH, ST, CO and BT); abundant cover and high instream complexity for rearing; moderate to high overwintering is attributed to occasional deep pools and perennial flow; moderate to high potential for spawning, although limited in sections with high percentages of large cobble and boulder; water quality monitoring is recommended for both trenched and trenchless options. If instream construction is required, DFO has endorsed that infringement on the earlier side of the August 7-10 window is preferred.

TRITON Environmental Consultants

TRANSMOUNTAIN

Trans Mountain Expansion Project

Coldwater River

AK 1.4

Survey Date: July 7, 2020
Drawn By: M. Von Sprecken **Approved By:** I. Emerson
Date Issued: July 22, 2020

TMEP site: CWGB-04a
UTM Zone: 10 656740 **E** 5548408 **N** **NAD 83**

Sensitivity 🔴


View upstream through centre of the PPC (08-07-20)


View downstream through centre of the PPC (08-07-20)


View of left bank approach at centre of the PPC (08-07-20)


View of right bank approach at centre of the PPC (08-07-20)

Channel Morphology

Pattern: Irregular Meander
Confinement: Frequently Confined
Bank Shape LB: Sloping
RB: Sloping
Habitat Unit at ROW: Run-Riffle
Habitat Unit through ZOI: Run-Riffle
Gradient (%): 2
Main Stem: Coldwater River

	Mean (m)	Range (m)
Wetted Width:	18.7	11.0 – 26.0
Channel Width:	59.7	30.0 – 91.0
Bank Height:	1.57	1.30 – 2.50
Res. Pool Depth:	0.54	0.40 – 0.70

Water Quality/Quantity

Water Temperature (°C): 9.9
Conductivity (µS/cm): 106.0
pH: 8.30
D. Oxygen (mg/L): -
Discharge (m^3/s): 2.32 (13-10-19)
Flow Regime: Perennial
Turbidity: Clear

Substrate *(ROW)*

Organics: 0
Fines: 10
Sml Gravel: 10
Lrg Gravel: 30
Sml Cobble: 40
Lrg Cobble: 10
Boulder: 0
Bedrock: 0

Cover

Dominant: Boulder
Subdominant: Deep Pools

Riparian

Type: Deciduous/Grass
Maturity: YF/Shrub
Crown Closure: 21-40%

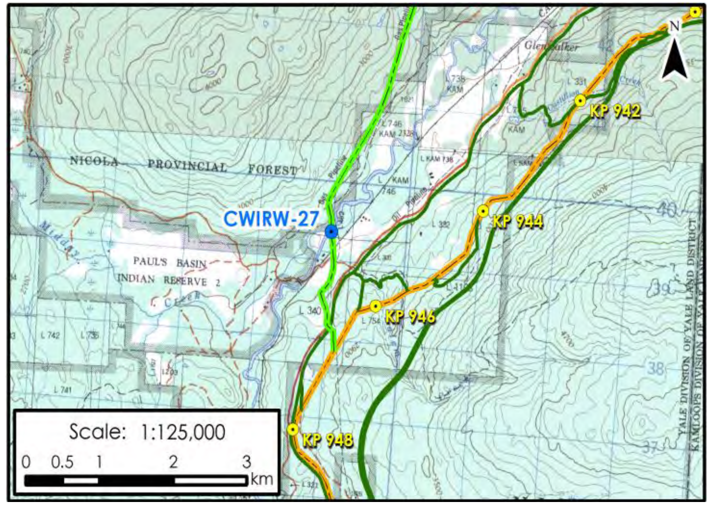
Fish Presence and Life History Stage

Species	YOY	Juv	Adult	Unknown
-	-	-	-	-

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
BT/DV	M	M-H	M-H	M-H
CO	M	M-H	M-H	M-H
CH	M	M-H	M-H	M-H
MW	M	M-H	M-H	M-H
RB/ST	M	M-H	M-H	M-H

Sampling Effort Method	Time	Distance	Date
-	-	-	-



Source: NRC, Centre for Topographical Information. 2013 (1:125,000)

Provincial Window of Least Risk:
July 22 – August 1

Least Risk Biological Window Proposed:
July 22 – August 10

Construction Timing:
Anytime - Trenchless

Stream Classification BC: S1B
Navigability: Navigable
Reason for Decision: Width >5 m
Barriers to Fish Movement: No

Recommended Primary Pipeline Crossing Method:
HDD with water quality monitoring

Recommended Contingency Pipeline Crossing Method:
Isolation with fish salvage during low flow or open-cut inside DFO endorsed window; water quality monitoring required

Recommended Vehicle Crossing Method (Non-Frozen):
Clear-Span Bridge or access both banks

Recommended Vehicle Crossing Method (Dry/Frozen):
Clear-Span Bridge or access both banks

Historical Fish Presence:
BT, CC, CH, CO, DV, L, LDC, LNC, MW, PL, RB, RSC, ST, SU

Comments:
Moderate to high potential for salmonids (e.g., CH, ST, CO and BT); abundant cover and high instream complexity for rearing; moderate to high overwintering (occasional deep pools and perennial flow); moderate potential for spawning (areas of suitable gravel substrate, although limited by high percentages of large cobble and boulders with moderate embeddedness); water quality monitoring is recommended for both trenched and trenchless options. If instream construction is required, DFO has endorsed that infringement on the earlier side of the August 7-10 window is preferred.

TRITON Environmental Consultants
TRANSMOUNTAIN

Trans Mountain Expansion Project

Coldwater River

AK 16.47

Survey Date: July 08, 2020
Drawn By: M. Von Sprecken **Approved By:** I. Emerson
Date Issued: July 22, 2020

TMEP site: CWIRW-27
UTM Zone: 10 648884 **E** 5539576 **N** **NAD 83**

Sensitivity ●


View upstream through centre of the PPC (18-11-19)


View downstream through centre of the PPC (18-11-19)


View of left bank approach at centre of the PPC (18-11-19)


View of right bank approach at centre of the PPC (18-11-19)

Channel Morphology

Pattern: Sinuous
Confinement: Unconfined
Bank Shape LB: Sloping
RB: Sloping
Habitat Unit at ROW: Riffle
Habitat Unit through ZOI: Riffle
Gradient (%): 4
Main Stem: Coldwater River, FB, 150 m DS

	Mean (m)	Range (m)
Wetted Width:	-	-
Channel Width:	3.00	1.85 - 6.80
Bank Height:	0.69	0.15 - 1.65
Res. Pool Depth:	-	-

Water Quality/Quantity

Water Temperature (ºC): -
Conductivity (µS/cm): -
pH: -
D. Oxygen (mg/L): -
Discharge (m^3/s): -
Flow Regime: Intermittent
Turbidity: -

Substrate (*ROW*)

Organics:	0
Fines:	45
Sml Gravel:	25
Lrg Gravel:	15
Sml Cobble:	10
Lrg Cobble:	5
Boulder:	0
Bedrock:	0

Cover

Dominant: None
Subdominant: None

Riparian

Type: None
Maturity: NA
Crown Closure: 0%

Fish Presence and Life History Stage

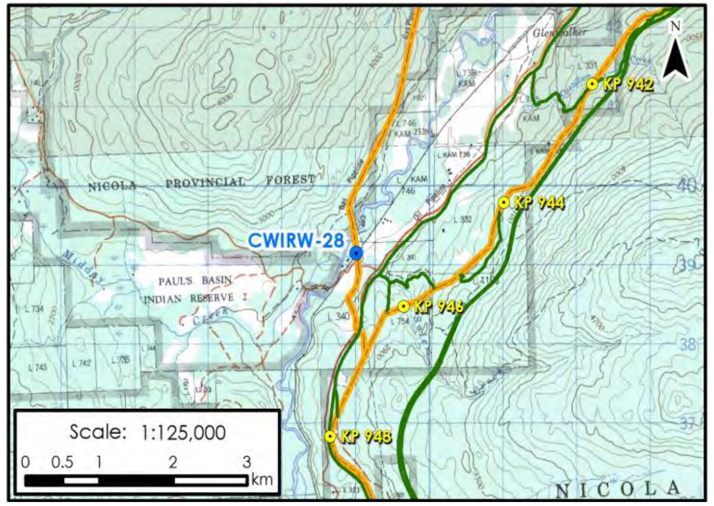
Species	YOY	Juv	Adult	Unknown
RB	-	1	-	-

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
RB/ST	L	L	L	L

Sampling Effort

Method	Time	Distance	Date
EF	386 s	100 m	14-05-13



Source: NRC, Centre for Topographical Information. 2013 (1:125,000)

Provincial Window of Least Risk:
July 22 - October 31

Least Risk Biological Window Proposed:
Open

Construction Timing:
Summer/Winter

Stream Classification BC:	S3
Navigability:	Non-Navigable; Class 2
Reason for Decision:	Width 1.2 - 3 m; Depth 0.3 - 0.6 m
Barriers to Fish Movement:	Yes

Recommended Primary Pipeline Crossing Method:
Isolation with fish salvage and water quality monitoring if flowing

Recommended Contingency Pipeline Crossing Method:
Open-cut if dry or frozen to bottom

Recommended Vehicle Crossing Method (Non-Frozen):
Ramp and Culvert or Clear-Span Bridge

Recommended Vehicle Crossing Method (Dry/Frozen):
Ramp and Culvert or Clear-Span Bridge or other regulatory approved crossing method

Historical Fish Presence:
No Previously Documented Fish Presence

Comments:
Dry/Intermittent watercourse with low fish habitat potential; one juvenile RB was captured downstream from Coldwater Road in May 2013; however, potential for fish presence is limited to spring flow conditions, as channel is dry for much of the year (dry in October 2012 and November 2019); rearing potential is limited by high disturbance (i.e., cattle grazing), lack of year-round flow, and absence of cover throughout the ZOI; dry winter conditions preclude overwintering; disturbed channel bed, high fines, and lack of flow limit potential for spawning; migration is limited by poor channel definition downstream from the PPC.

TRITON Environmental Consultants
TRANSMOUNTAIN

Trans Mountain Expansion Project

Salem Creek

AK 16.7

Survey Date: November 18, 2019
Drawn By: R. Tomlinson **Approved By:** I. Emerson
Date Issued: November 19, 2019

TMEP site: CWIRW-28
UTM Zone: 10 648916 **E** 5539363 **N** **NAD 83**

Sensitivity
●

APPENDIX D

NONFISH-BEARING ATLAS FOR THE WEST ALTERNATIVE Pipeline

View upslope at 30 m upslope from centre of PPC (05-07-13)

View downslope at 30 m upslope from centre of PPC (05-07-13)

View of N approach at 30 m upslope from centre of PPC (05-07-13)

View of S approach at 30 m upslope from centre of PPC (05-07-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWGB-01 — **AK** **0.04**
	UTM Zone: 10 658010 E 5548513 N NAD 83

View upslope through centre of PPC (07-07-20)

View downslope through centre of PPC (07-07-20)

View of W approach at centre of PPC (07-07-20)

View of E approach at centre of PPC (07-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water of fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWGB-02	**AK** **0.9**
		UTM Zone: 10 657229 E 5548350 N NAD 83	

View upslope through centre of PPC (07-07-20)

View downslope through centre of PPC (07-07-20)

View of W approach at centre of PPC (07-07-20)

View of E approach at centre of PPC (07-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Clearwater River (FB), 100 m downslope

Comment: Seasonal drainage with extensive scour but no continuous defined channel; dry at time of assessment (July 2020) but may contain overflow water from the Clearwater River during flood conditions; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWGB-03 — **AK** **1.33**
	UTM Zone: 10 656821 E 5548399 N NAD 83

View upslope at 320 m upslope from centre of PPC (09-10-19)

View downslope at 320 m upslope from centre of PPC (09-10-19)

View E at 320 m upslope from centre of PPC (09-10-19)

View W at 320 m upslope from centre of PPC (09-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), 2.1 km downslope

Comment: Seasonal drainage with short sections of scour and overland flow (i.e., evidence of hydrophilic vegetation), although dry at the time of assessment (October 2019); no continuous defined channel greater than 100 m; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	**AK 3.08**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWGB-09	
		UTM Zone: 10 655266 E 5548582 N NAD 83	

View upslope through centre of PPC (08-07-20)

View downslope through centre of PPC (08-07-20)

View of E approach at centre of PPC (08-07-20)

View of W approach at centre of PPC (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	Unnamed Drainage	AK 3.25
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWGB-10	
	UTM Zone: 10 655100 E 5548602 N NAD 83	

View upslope through centre of PPC (08-07-20)

View downslope through centre of PPC (08-07-20)

View of E approach at centre of PPC (08-07-20)

View of W approach at centre of PPC (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), 2.0 km downslope

Comment: Seasonal drainage with overland flow and pockets of standing water; frozen to bottom at time of assessment (October 2019); no continuous defined channel greater than 100 m; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 3.49**
TRITON Environmental Consultants TRANSMOUNTAIN	**TMEP Site ID:** CWGB-11	
	UTM Zone: 10 654863 E 5548629 N NAD 83	

View upslope through centre of PPC (08-07-20)

View downslope through centre of PPC (08-07-20)

View of E approach at centre of PPC (08-07-20)

View of W approach at centre of PPC (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK** 3.55
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWGB-12	
	UTM Zone: 10 654820 E 5548635 N NAD 83	

View upslope at 160 m upslope from centre of PPC (09-10-19)

View downslope at 160 m upslope from centre of PPC (09-10-19)

View E at 160 m upslope from centre of PPC (09-10-19)

View W at 160 m upslope from centre of PPC (09-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 4.16**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWGB-13	
	UTM Zone: 10 654191 E 5548708 N NAD 83	

View upslope at 140 m upslope from centre of PPC (09-10-19)

View downslope at 140 m upslope from centre of PPC (09-10-19)

View E at 140 m upslope from centre of PPC (09-10-19)

View W at 140 m upslope from centre of PPC (09-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale; no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	**AK** 4.50
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWGB-14	
		UTM Zone: 10 653862 E 5548769 N NAD 83	

View upslope through centre of PPC (09-10-19)

View downslope through centre of PPC (09-10-19)

View of SE approach at centre of PPC (09-10-19)

View of NW approach at centre of PPC (09-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	**AK** 4.97
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-13	
		UTM Zone: 10 653488 E 5549043 N NAD 83	

View upslope through centre of PPC (10-10-19)

View downslope through centre of PPC (10-10-19)

View upslope at 20m downslope from the PPC (10-10-19)

View downslope at 20m downslope from the PPC (10-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), >2.5 km downslope

Comment: Seasonal drainage with dense vegetation (Red-osier Dogwood) at the centre of the PPC; dry at time of assessment (October 2019); short sections of scour, but no continuous defined channel greater than 100 m; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK** 5.26
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-14	
	UTM Zone: 10 653243 E 5549089 N NAD 83	

View upstream through centre of PPC (08-07-20)

View downstream through centre of PPC (08-07-20)

View of left bank approach at centre of the PPC (08-07-20)

View of right bank approach at centre of the PPC (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: S6

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: 0.38 m

Proximity to other watercourses: Coldwater River (FB), >2.5 km downslope

Comment: Small, marginally defined watercourse (upper headwaters of Lemoto Creek); mostly dry in October 2019 and minimal discharge observed in July 2020; no fish habitat potential, gradient barriers downslope (>25%).

Trans Mountain Expansion Project	**Lemoto Creek**	**AK** 5.37
TRITON Environmental Consultants TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-15	
	UTM Zone: 10 653121 E 5549057 N NAD 83	

View upslope through centre of PPC (10-10-19)

View downslope through centre of PPC (10-10-19)

View of E approach at centre of PPC (10-10-19)

View of W approach at centre of PPC (10-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale (shallow draw situated within open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	**AK 6.07**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-16	
		UTM Zone: 10 652520 E 5548764 N NAD 83	

View upslope through centre of PPC (11-10-19)

View downslope through centre of PPC (11-10-19)

View of W approach at centre of PPC (11-10-19)

View of E approach at centre of PPC (11-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale (small draw with dense Red-Osier Dogwood and Alder); slight soil saturation, but no defined channel or evidence of fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK** 6.94
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-17	
	UTM Zone: 10 651879 E 5548296 N NAD 83	

View upslope at 200 m downslope from centre of PPC (11-10-19)

View downslope at 200 m downslope from centre of PPC (11-10-19)

View N at 200 m downslope from centre of PPC (11-10-19)

View S at 200 m downslope from centre of PPC (11-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; crossing is located at the upslope end of the mapped feature (Oluk Creek); no fish habitat potential.

Trans Mountain Expansion Project	**Oluk Creek**	**AK** 8.73
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-18	
	UTM Zone: 10 650846 E 5547075 N NAD 83	

View upslope at 180 m downslope from centre of PPC (11-10-19)

View downslope at 180 m downslope from centre of PPC (11-10-19)

View N at 180 m downslope from centre of PPC (11-10-19)

View S at 180 m downslope from centre of PPC (11-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 9.13**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-19	
	UTM Zone: 10 650705 E 5546686 N NAD 83	

View upslope at 110 m downslope from centre of PPC (11-10-19)

View downslope at 110 m downslope from centre of PPC (11-10-19)

View N at 110 m downslope from centre of PPC (11-10-19)

View S at 110 m downslope from centre of PPC (11-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK** 9.58
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-20 **UTM Zone:** 10 650608 E 5546262 N NAD 83

View upslope at 50 m downslope from centre of PPC (11-10-19)

View downslope at 50 m downslope from centre of PPC (11-10-19)

View N at 50 m downslope from centre of PPC (11-10-19)

View S at 50 m downslope from centre of PPC (11-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 9.83**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-21
		UTM Zone: 10 650557 E 5546006 N NAD 83

View upslope at 20 m downslope from PPC (12-10-19)

View downslope at 20 m downslope from PPC (12-10-19)

View of N approach at 20 m downslope from PPC (12-10-19)

View of S approach at 20 m downslope from PPC (12-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), >2.5 km downslope

Comment: Seasonal drainage with short sections of scour and overland flow, but no continuous defined channel greater than 100 m; densely vegetated (Red-Osier Dogwood) at centre of the PPC; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	**AK** **10.86**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-22	
		UTM Zone: 10 650295 E 5545084 N NAD 83	

View upslope through centre of PPC (12-10-19)

View downslope through centre of PPC (12-10-19)

View of N approach at centre of PPC (12-10-19)

View of S approach at centre of PPC (12-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale (dense Red-Osier Dogwood); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 11.05**
TRITON Environmental Consultants TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-23	
	UTM Zone: 10 650225 E 5544906 N NAD 83	

View upslope through centre of PPC (12-10-19)

View downslope through centre of PPC (12-10-19)

View of N approach at centre of PPC (12-10-19)

View of S approach at centre of PPC (12-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale (sparse Red-Osier Dogwood and Alder); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK** 13.43
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-24
		UTM Zone: 10 649805 E 5542632 N NAD 83

View upslope through centre of PPC (12-10-19)

View downslope through centre of PPC (12-10-19)

View of N approach at centre of PPC (12-10-19)

View of S approach at centre of PPC (12-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated hillside (open forest and grassland) with no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK** 13.94
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-25 **UTM Zone:** 10 649665 E 5542146 N NAD 83

View upslope through centre of PPC (13-10-19)

View downslope through centre of PPC (13-10-19)

View of N approach at centre of PPC (13-10-19)

View of S approach at centre of PPC (13-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale with no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 14.95**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-26
		UTM Zone: 10 649414 E 5541164 N NAD 83

View upslope through centre of PPC (18-11-19)

View downslope through centre of PPC (18-11-19)

View of S approach at centre of PPC (18-11-19)

View of N approach at centre of PPC (18-11-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), 260 m downslope

Comment: Small drainage through agricultural field that may convey seasonal overland flow; sections of scour observed, but no continuous defined channel; no fish habitat potential; two culverts located underneath the Kettle Valley Rail Trail were observed to be in poor condition.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 17.01**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** CWIRW-28a	
	UTM Zone: 10 648929 E 5539276 N NAD 83	

View upslope through centre of PPC (14-10-19)

View downslope through centre of PPC (14-10-19)

View of W approach at centre of PPC (14-10-19)

View of E approach at centre of PPC (14-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Agricultural field with no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**	**AK 17.43**
TMEP Site ID:	CWIRW-29	
UTM Zone:	10 648855 E 5538872 N NAD 83	

APPENDIX E

NONFISH-BEARING ATLAS FOR THE WEST ALTERNATIVE
Access

View upslope at proposed vehicle crossing (05-07-13)

View downslope at proposed vehicle crossing (05-07-13)

View of N approach at proposed vehicle crossing (05-07-13)

View of S approach at proposed vehicle crossing (05-07-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-01
	UTM Zone: 10 658041 E 5548496 N NAD 83

View upslope at proposed vehicle crossing (09-05-13)

View downslope at proposed vehicle crossing (09-05-13)

View of N approach at at proposed vehicle crossing (09-05-13)

View of S approach at proposed vehicle crossing crossing (09-05-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest and grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**		
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-02		**KP** 931.81
		UTM Zone: 10 657958 E 5548171 N NAD 83		

View upslope at proposed vehicle crossing (09-05-13)

View downslope at proposed vehicle crossing (09-05-13)

View of S approach at proposed vehicle crossing (09-05-13)

View of N approach at proposed vehicle crossing (09-05-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-03	**KP** 932.31
		UTM Zone: 10 657607 E 5547824 N NAD 83	

View upslope at proposed vehicle crossing (09-05-13)

View downslope at proposed vehicle crossing (09-05-13)

View of S approach at proposed vehicle crossing (09-05-13)

View of N approach at proposed vehicle crossing (09-05-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**	
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-04	**KP** 932.49
		UTM Zone: 10 657465 E 5547711 N NAD 83	

View upslope through at proposed vehicle crossing (10-05-13)

View downslope at proposed vehicle crossing (10-05-13)

View of S approach at proposed vehicle crossing (10-05-13)

View of N approach at proposed vehicle crossing (10-05-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (grassland); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TMEP Site ID: BCVA-CWA-05	**KP** 932.52
UTM Zone: 10 657444 E 5547689 N NAD 83	

View upslope at proposed vehicle crossing (10-05-13)

View downslope at proposed vehicle crossing (10-05-13)

View of S approach at proposed vehicle crossing (10-05-13)

View of N approach at proposed vehicle crossing (10-05-13)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), 1.4 km downslope

Comment: Vegetated swale with areas of groundwater seepage; no continuous defined channel; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-06 — **KP** 932.68
	UTM Zone: 10 657333 E 5547588 N NAD 83

View upslope at proposed vehicle crossing (08-07-20)

View downslope at proposed vehicle crossing (08-07-20)

View of E approach at proposed vehicle crossing (08-07-20)

View of W approach at proposed vehicle crossing (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-08
		UTM Zone: 10 655100 E 5548602 N NAD 83

View upslope through centre of proposed access road (08-07-20)

View downslope through centre of proposed access road (08-07-20)

View of S approach at centre of proposed access road (08-07-20)

View of N approach at centre of proposed access road (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), > 2.5 km downslope

Comment: Vegetated swale with areas of groundwater seepage; no continuous defined channel; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-09
	UTM Zone: 10 651409 E 5548328 N NAD 83

View upslope through centre of proposed access road (08-07-20)

View downslope through centre of proposed access road (08-07-20)

View of N approach at centre of proposed access road (08-07-20)

View of S approach at centre of proposed access road (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), > 2.5 km downslope

Comment: Vegetated swale with areas of groundwater seepage; no continuous defined channel; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-10 **UTM Zone:** 10 651141 E 5547734 N NAD 83

View upslope through centre of proposed access road (08-07-20)

View downslope through centre of proposed access road (08-07-20)

View of S approach at centre of access road (08-07-20)

View of N approach at centre of proposed access road (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), >2.5 km downslope

Comment: Vegetated swale with sections of groundwater seepage and overland flow; no continuous defined channel; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-11
		UTM Zone: 10 650566 E 5546404 N NAD 83

View upslope through centre of proposed access road (08-07-20)

View downslope through centre of proposed access road (08-07-20)

View of NE approach at centre of proposed access road (08-07-20)

View of SW approach at centre of proposed access road (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), >2.5 km downslope

Comment: Vegetated swale with sections of groundwater seepage and overland flow; no continuous defined channel; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-12
	UTM Zone: 10 650467 E 5546184 N NAD 83

View upslope through centre of proposed access road (08-07-20)

View downslope through centre of proposed access road (08-07-20)

View of NE approach at centre of proposed access road (08-07-20)

View of SW approach at centre of proposed access road (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: Coldwater River (FB), >2.5 km downslope

Comment: Vegetated swale with sections of scour, groundwater seepage, and overland flow; no continuous defined channel, no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-13
	UTM Zone: 10 650211 E 5545327 N NAD 83

View upslope through centre of proposed access road (08-07-20)

View downslope through centre of proposed access road (08-07-20)

View of N approach at centre of proposed access road (08-07-20)

View of S approach at centre of proposed access road (08-07-20)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Dry upland site (open forest); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-14
		UTM Zone: 10 650195 E 5544913 N NAD 83

View upslope at 600 m upslope from proposed vehicle crossing (12-10-19)

View downslope at 600 m upslope from proposed vehicle crossing (12-10-19)

View of N approach at 600 m upslope from proposed vehicle crossing (12-10-19)

View of S approach at 600 m upslope from proposed vehicle crossing (12-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale (sparse Red-Osier Dogwood and Alder); no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-15
	UTM Zone: 10 649574 E 5543218 N NAD 83

View upslope at 430 m upslope from proposed vehicle crossing (12-10-19)

View downslope at 430 m upslope from proposed vehicle crossing (12-10-19)

View of N approach at 430 m upslope from proposed vehicle crossing (12-10-19)

View of S approach at 430 m upslope from proposed vehicle crossing (12-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated hillside (open forest and grassland) with no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-16
		UTM Zone: 10 649422 E 5542503 N NAD 83

View upslope at 475 m upslope from proposed vehicle crossing (13-10-19)

View downslope at 475 m upslope from proposed vehicle crossing (13-10-19)

View of N approach at 475 m upslope from proposed vehicle crossing (13-10-19)

View of S approach at 475 m upslope from proposed vehicle crossing (13-10-19)

Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NVC

Least Risk Window Proposed: Open

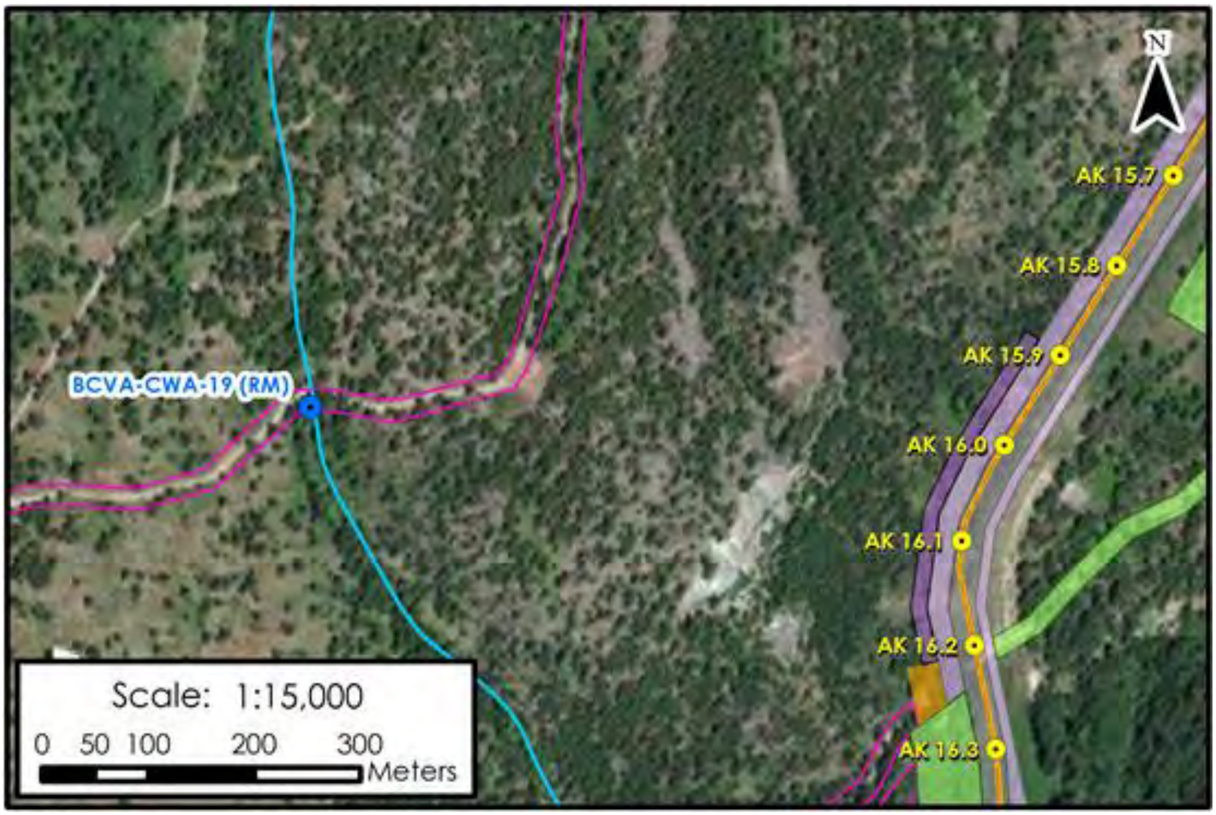
Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: Vegetated swale with no defined channel or evidence of water or fluvial processes; no fish habitat potential.

Trans Mountain Expansion Project	**Unnamed Drainage**
TRITON Environmental Consultants / TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-17 / BCVA-CWA-18
	UTM Zone: 10 649137 E 5541548 N NAD 83
	UTM Zone: 10 649071 E 5541665 N NAD 83



Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

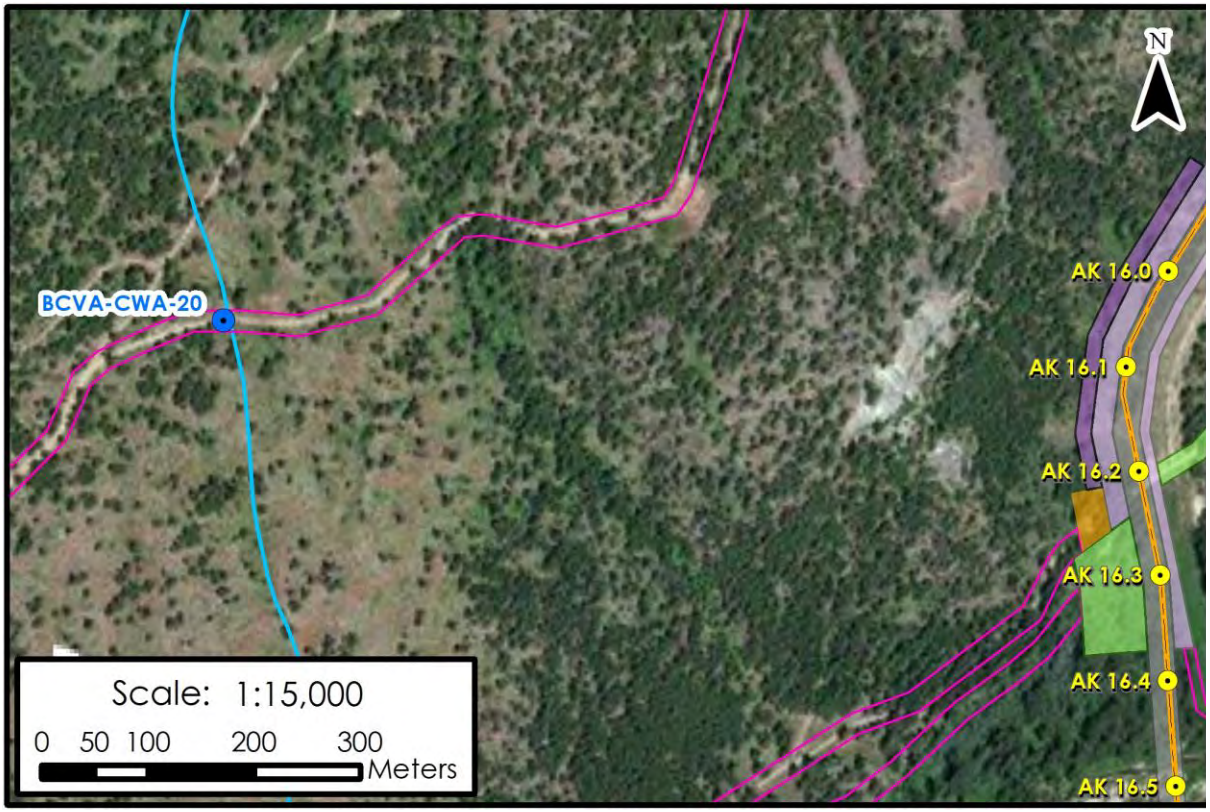
Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential. Risk manage as NCD.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-19 (RM) **UTM Zone:** 10 648183 E 5540042 N NAD 83



Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

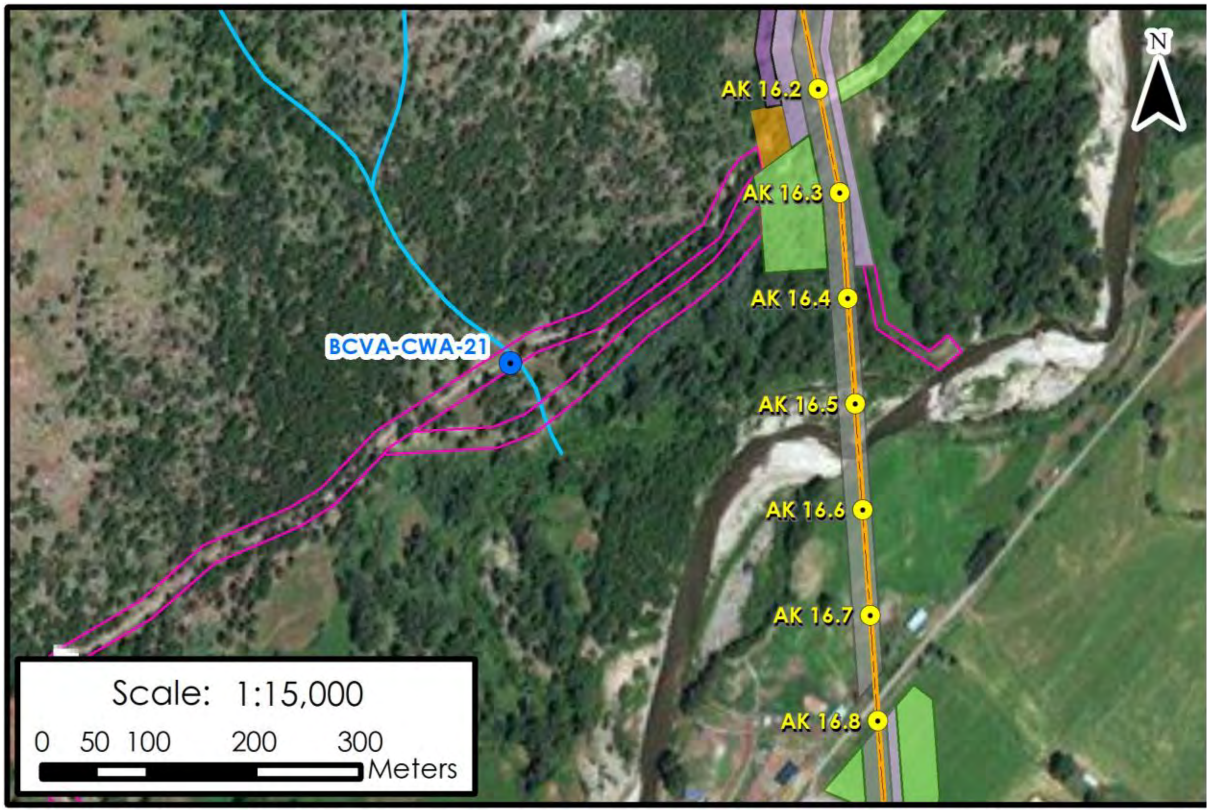
Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential. Risk manage as NCD.

Trans Mountain Expansion Project		**Unnamed Drainage**	
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-20	
		UTM Zone: 10 647954 E 5539941 N NAD 83	



Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

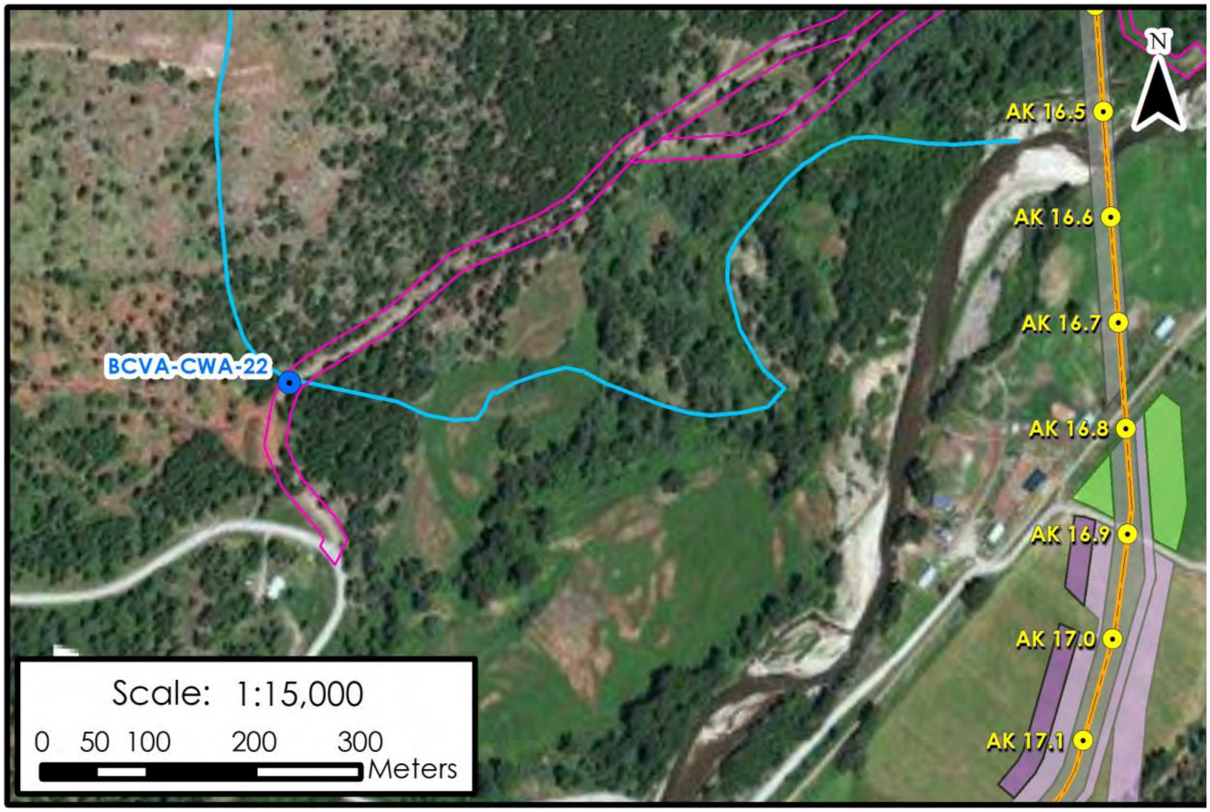
Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential. Risk manage as NCD.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-21
		UTM Zone: 10 648557 E 5539587 N NAD 83



Fish Habitat Potential

Species	Spawning	Rearing	Wintering	Migration
All	N	N	N	N

Sampling Effort

Method	Time	Distance	Date
(none)	-	-	-

Classification: NCD

Least Risk Window Proposed: Open

Navigability: (none)

Mean Channel Width: (none)

Proximity to other watercourses: (none)

Comment: No site visit conducted; Upland site (open forest); no evidence of a defined channel or evidence of water or fluvial processes; no fish habitat potential. Risk manage as NCD.

Trans Mountain Expansion Project		**Unnamed Drainage**
TRITON Environmental Consultants	TRANSMOUNTAIN	**TMEP Site ID:** BCVA-CWA-22
		UTM Zone: 10 648140 E 5539258 N NAD 83

APPENDIX C

WETLAND TECHNICAL DATA REPORT

WETLANDS TECHNICAL DATA REPORT FOR THE COLDWATER WEST ALTERNATIVE REROUTE FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

September 2020
FINAL
01-13283-S5A-M002-EV-RPT-0007

Prepared for:

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

Jacobs Consultancy Canada Inc.
205 Quarry Park Blvd SE
Calgary, Alberta T2C 3E7
Ph. 403-407-8700

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
AK	Alternative Kilometre Post
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC GEO	British Columbia Government's Environmental Objectives
BC OGC	British Columbia Oil and Gas Commission
BEC	Biogeoclimatic Ecosystem Classification
BG	bunchgrass
BGC	biogeoclimatic
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
Coldwater IR	Coldwater Indian Reserve No. 1
Coldwater Reroute ESA	Environmental and Socio-Economic Assessment for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project
CPCN	Certificate of Public Convenience and Necessity
CWCS	Canadian Wetland Classification System
DPI	Direct Pipe® Installation
EAS	Environmental Alignment Sheets
EPMR	*Environmental Protection and Management Regulation*
EPP	Environmental Protection Plan
ESA	Environmental and Socio-economic Assessment
FPWC	Federal Policy on Wetland Conservation
ha	hectare(s)
HDD	horizontal directional drill
km	kilometre(s)
KP	Kilometre Post
LSA	Local Study Area
m	metre(s)
mm	millimetre(s)
NEB	National Energy Board
OGAA	*Oil and Gas Activities Act*
POM	Planning and Operational Measure
PP	Ponderosa Pine
RMA	Riparian Management Area
RMZ	Riparian Management Zone
RRZ	Riparian Reserve Zone
RSA	Regional Study Area
the Application	Facilities Application under Section 52 of the *National Energy Board Act*
the Approved Route	the route previously approved by the Canada Energy Regulator - Project corridor that passed to the east of Coldwater Indian Reserve No. 1
the Project or TMEP	Trans Mountain Expansion Project
the Reroute	approximately 18.4 km Reroute of the Project
the West Alternative Route	a western route option that avoided the Coldwater Indian Reserve No. 1
Trans Mountain	Trans Mountain Pipeline ULC
WSA	*Water Sustainability Act*

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) submitted a Facilities Application under Section 52 of the *National Energy Board Act* (the Application) to the Canada Energy Regulator (CER) (formerly the National Energy Board [NEB]) in December 2013 for the Trans Mountain Expansion Project (the Project or TMEP). A Certificate of Public Convenience and Necessity (CPCN) was issued by the CER on June 21, 2019.

Trans Mountain is proposing an approximately 18.4 km reroute (the Reroute) from the current Project routing in proximity to the Coldwater Indian Reserve No. 1 (Coldwater IR) in British Columbia (BC). A western route option that avoided the Coldwater IR (the West Alternative Route) was considered during early Project planning however was ultimately not selected as a preferred route (refer to Section 4.2 of the original Environmental and Socio-economic Assessment [ESA] [Filing ID A3S1L4]).

Coldwater Indian Band has suggested that a refined West Alternative Route be considered, and Trans Mountain committed to conducting a feasibility study in response to concerns raised by Coldwater Indian Band regarding the route previously approved by the CER (the Approved Route). The approximately 18.4 km long Reroute deviates from the Approved Route at KP 931.36, re-joining at KP 946.88 (Figure 1). The Reroute was not included in the approved pipeline corridor; therefore, an Application for Variance under Section 190 of the *Canadian Energy Regulator Act* (*CER Act*) is required to vary the CPCN to reflect changes to the previously-approved Application.

Trans Mountain is proposing two trenchless crossings of the Coldwater River – one at the north end and one at the south end of the Reroute. In the Western Feasibility Study, filed in April 2020, Trans Mountain put forward plans to use a horizontal directional drill (HDD) crossing method for both crossings. Since that time, and with the benefit of additional geotechnical drilling results, Trans Mountain has decided to implement alternate trenchless construction methods for the northern crossing due to challenging geotechnical conditions in that area. These alternative and preferred methods are by Direct Pipe® Installation (DPI) and, as a contingency should the DPI prove infeasible, micro-tunnelling. Trans Mountain's primary considerations are to install the crossing in a manner that avoids disturbance to the Coldwater River, while also reducing the technical risks of the crossing based on the geotechnical conditions.

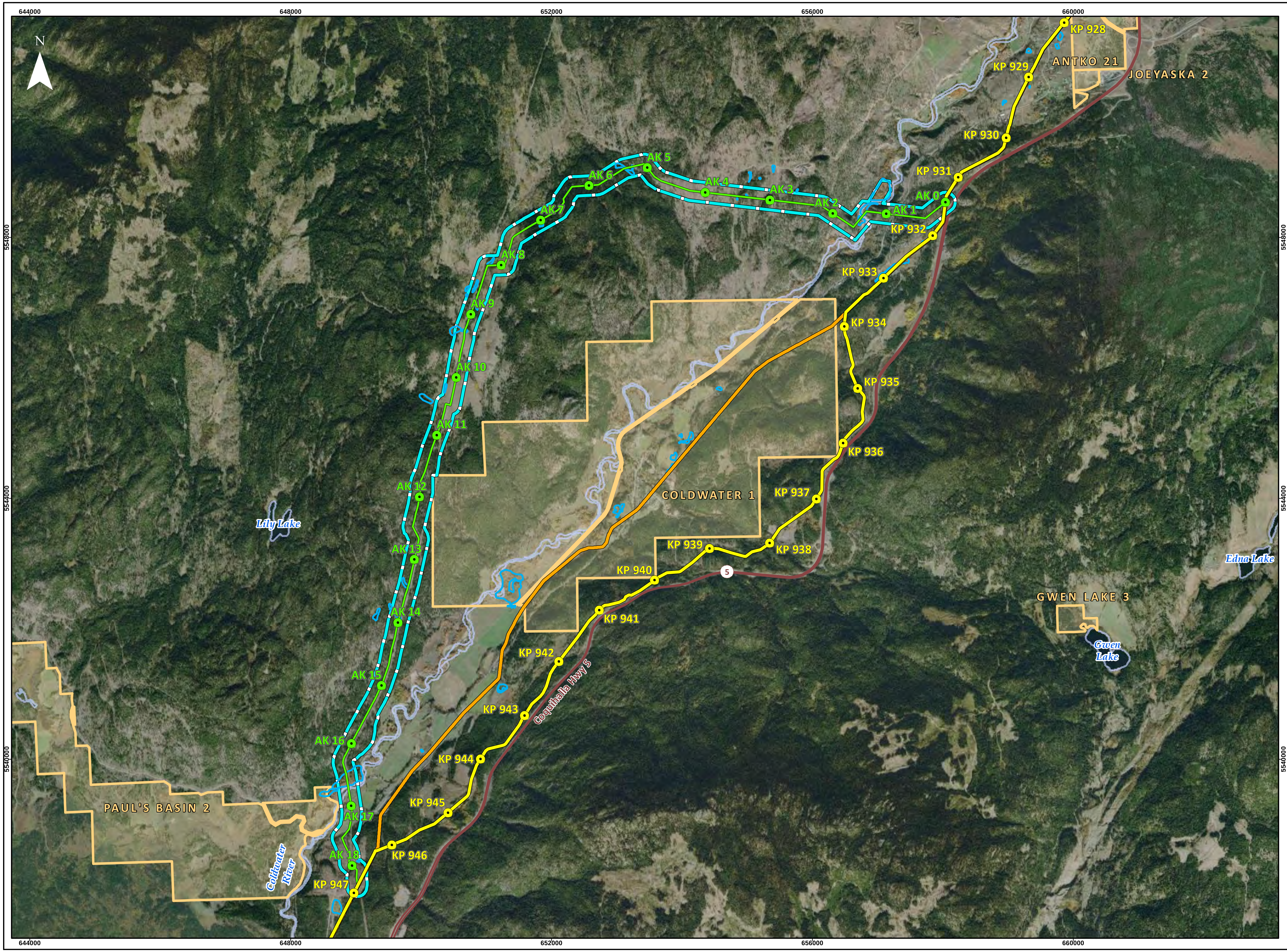
Trans Mountain commissioned Jacobs Consultancy Canada Inc. (Jacobs) to complete a wetland survey and associated desktop review and field data collection, including a field reconnaissance in October 2019 and surveys in July 2020, for the Reroute to support the preparation of an ESA for the Reroute.

The objectives of the wetland survey completed for the Reroute were to:

- Provide guidance on the Federal and Provincial regulatory context that applies to the disturbance of wetlands by construction activities.
- Characterize wetlands in the Reroute study area via desktop review to support the understanding of existing environmental conditions and the assessment of potential effects in the ESA.
- Identify, delineate, and classify wetlands (and wetland-related features such as lakes and flood associations) encountered by the Reroute to support regulatory requirements related to wetlands.
- Support the route selection and inform the implementation of technically and economically feasible mitigation to reduce potential effects on wetlands.
- Collect wetland field data to obtain baseline information on wetlands, including wetland landscape function, in support of regulatory requirements to compare pre- and post-construction wetland functional conditions during post-construction monitoring of wetland recovery.
- Collect baseline data to inform implementation of the Wetland Survey and Mitigation Plan (Condition 41).

Field survey and desktop information was used to inform the assessment of potential adverse effects for wetlands, and to support the implementation of technically and economically feasible mitigation to reduce potential Project effects on wetlands. The potential residual and cumulative effects of the Reroute on wetland function, including an evaluation of significance, are presented in Section 7.2.8 of Volume 5A (Filing ID A3S1Q9), Section 8.7 of Volume 5A (Filing ID A3S1R2), an ESA Update (Filing ID A4F4Z3), Responses to Information Request No. 2.041 (Filing ID A3Z4T9), Response to Information Request No. 3.025 (Filing ID A4H1V2).

Mitigation measures to be applied at wetlands are provided in the Project-specific Environmental Protection Plan (EPP) (Filing ID C01961). Reroute-specific Environmental Resource Maps are provided in Appendix G of the Environmental and Socio-Economic Assessment for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project (Coldwater Reroute ESA) showing the Reroute corridor and summarizing the biophysical information gathered during field surveys completed to date and desktop research. If the Variance is approved, Reroute-specific Environmental Alignment Sheets (EAS) and Resource-Specific Mitigation Tables will be prepared and provided to the CER prior to construction.



TRANS MOUNTAIN

FIGURE 1

OVERVIEW OF THE COLDWATER WEST ALTERNATIVE REROUTE

WETLAND

PROPOSED TRANS MOUNTAIN PIPELINE ULC

- ● Coldwater Reroute Kilometre Post (AK)
- ● TMEP Pipeline Kilometre Post (KP)
- — Coldwater Reroute
- — TMEP Pipeline
- — Existing TMPL Pipeline
- ① Highway
- ▭ Coldwater Reroute 300m Corridor
- ▭ Indian Reserve
- ▭ Hydrology
- ▭ Wetland

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 08, 2020; Transportation: BC MFLNRO 2012; Hydrology: BC MFLNRO 2008; First Nation Lands: Government of Canada 2018; Wetland: Jacobs, August 28, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202008_MAP_CH2M_WT_01193_REV1_FIG1

DATE September 2020	REFERENCE CE771600	REVISION 1
SCALE 1:55,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SAB	CHECKED DJN	DESIGN CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_WT_01193_Rev1_Fig1.mxd

2.0 REGULATORY CONTEXT

Regulatory guidance on Federal and Provincial standards, legislation and approvals applicable to the interaction of Project activities with wetlands is provided as follows.

2.1 Federal Standards

The principal policy related to the protection of wetlands at the Federal level is provided in the Federal Policy on Wetland Conservation (FPWC).

2.1.1 Federal Policy on Wetland Conservation

The objective of the FPWC (Government of Canada 1991) is to promote conservation of Canada's wetlands to sustain their ecological and socio-economic functions. To support this objective, several goals have been established by the FPWC that identify the importance of wetland function. Goals of the FPWC include:

- “No net loss” of wetland function on Federal lands and waters.
- Enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands or their functions have reached critical levels.
- Recognition of wetland functions in resource planning, management, and economic decision-making with regard to all Federal programs, policies and activities.
- Maintenance of the functions and values derived from wetlands throughout Canada.
- Securement of wetlands of significance to Canadians.
- Recognition of sound, sustainable management practices in sectors such as forestry and agriculture that make a positive contribution to wetland conservation while also achieving wise use of wetland resources.
- Utilization of wetlands in a manner that enhances prospects for their sustained and productive use by future generations.

The FPWC commits all Federal departments and projects to the goal of “no net loss” of wetland function on Federal lands and waters (Government of Canada 1991; Lynch-Stewart 1992; Lynch-Stewart et al. 1996), and guiding principles for use by the Federal government in pursuing the objective of the FPWC to acknowledge that wetland conservation function can only be achieved through the cooperation of the private sector. The means for achieving “no net loss” (*e.g.* avoidance and mitigation) should be incorporated into Project planning.

2.2 Provincial Standards

Provincial legislation that provides protection of wetlands (and other aquatic/riparian systems) is provided under the *Environmental Protection and Management Regulation* (*EPMR*) (BC OGC 2018b) of the *Oil and Gas Activities Act* (*OGAA*), and the *Water Sustainability Act* (*WSA*) (B.C. Reg. 36/2016), described as follows.

2.2.1 British Columbia Oil and Gas Activities Act and Environmental Protection and Management Regulation

The *OGAA* regulates oil and gas and related activities in BC, including wells, facilities, oil refineries, natural gas processing plants, pipelines and oil and gas roads, through permits, authorizations, orders and regulations.

The primary Provincial regulator for construction and operation of oil and gas projects in BC is the BC Oil and Gas Commission (BC OGC). The BC OGC has limited authorities with respect to Federally regulated pipeline projects and related ancillary activities, and in accordance with Sections 8 and 9 of the *OGAA*, these authorities do not include the power to issue pipeline approvals. However, the BC OGC has authority to issue specific environmental permits related to pipelines regulated under the *CER Act*, including approvals under the *WSA* (described as follows). While the Project is not regulated by the *OGAA* or the associated *EPMR*, the BC OGC will consider the *EPMR* in its review of the Reroute.

Under the OGAA, the *EPMR* establishes the BC Government's Environmental Objectives (BC GEOs). The BC GEOs related to "riparian values" are pertinent to the conservation of wetlands, lakes and streams, and they focus on avoiding activities within these ecosystems and the surrounding riparian areas, while allowing for certain exceptions.

The *EPMR* provides a list of Planning and Operational Measures (POMs) that should be met for works occurring in designated Riparian Management Areas (RMAs) associated with wetlands, lakes, and streams, if these areas cannot be avoided (BC OGC 2018a). RMAs are defined as transitional areas adjacent to wetlands, lakes or streams, where there is a distinct shift in vegetation from aquatic to upland communities, and they consist of a Riparian Reserve Zone (RRZ) and a Riparian Management Zone (RMZ) (BC OGC 2018a). The widths of RRZs and RMZs are dependent upon the *EPMR*-defined riparian class of the stream, wetland or lake. A summary of wetland and lake riparian classification is provided in the Methods section.

For wetlands, the *EPMR* emphasizes avoidance of W2 wetlands (*i.e.,* wetlands 0.25 ha to 5 ha in size), except to facilitate a crossing of the wetland, as per section 5(iii). Furthermore, avoidance of wetland RRZs and RMZs is recommended, except to facilitate a crossing of the wetland, or if there will be no material adverse effects on fish and wildlife habitat, biodiversity, water values, and the ability of the RMZ to protect the RRZ, as per sections 5(V) and 6(VI). Where avoidance as specified in the *EPMR* is not possible, a justification to the BC OGC may be required under the Provincial approval processes within the CER framework.

The *EPMR* applies to Crown land and does not apply to private land or to subsurface oil and gas activities associated with an operating area (including pipeline corridors) (BC OGC 2018a). However, the BC OGC will consider the *EPMR* and associated BC GEOs in its review of Provincial authorizations for CER-regulated pipeline projects (*e.g.*, the approval for Changes In and About a Stream under the *WSA*, described as follows), and it is recommended to apply appropriate mitigation measures for RMAs on private and Crown lands to meet the standards of the *EPMR*. The CER may also consider direction under the *EPMR* in its evaluation of applications. The ESA for the Project and the Reroute, as well as the Project-specific EPP (Filing ID C01961), include route selection processes and mitigation for riparian areas that align with BC OGC-recommended POMs for RMAs, ensuring adherence to the BC GEOs for riparian values.

2.2.2 Water Sustainability Act

The *WSA* is the principal law for managing the diversion and use of water resources in BC. Under the *WSA*, the *Water Sustainability Regulation* sets out the statutory requirements for the issuance of licenses or approvals for the diversion, use, or storage of surface water or groundwater, and for making Changes In and About a Stream. The definition of stream under the *WSA* is broad, and includes watercourses, wetlands, lakes and other aquatic features:

a) a natural watercourse, including a natural glacier course, or a natural body of water, whether or not the stream channel of the stream has been modified, or

b) a natural source of water supply, including, without limitation, a lake, pond, river, creek, spring, ravine, gulch, wetland or glacier, whether or not usually containing water, including ice, but does not include an aquifer (B.C. Reg. 36/2016).

For CER-regulated projects, the BC OGC has authority to an issue an approval for Changes In and About a Stream (including wetlands and lakes) in accordance with Section 11 of the *WSA*. Changes In and About a Stream refer to:

a) Any modification to the nature of the stream, including any modification of the land, vegetation, and natural environment of a stream or the flow of water in a stream, or

b) Any activity or construction within a stream channel that has or may have an impact on a stream or stream channel (B.C. Reg. 36/2016).

The *WSA* applies to activities on both Crown and private lands. As part of the application process for Changes In and About a Stream, *EPMR*-defined riparian classifications should be provided for streams, wetlands and lakes, and proponents should provide a document, such as an environmental management plan, describing the conformance of their proposed activities with each of the BC GEOs in the *EPMR* (BC OGC 2018b).

3.0 METHODS

The wetland survey was designed to identify and characterize wetlands and related features (*e.g.*, lakes and flood associations) within Regional, Local and Project footprint-focused study area boundaries relevant to the Project (for the entire 18.4 km Reroute), using applicable Federal and Provincial wetland definitions and classifications systems. At a Regional scale, wetlands were characterized using desktop review, and at Local and Project footprint scales, a combination of desktop review and field data collection methods were used, the same as was completed for the rest of the Project.

3.1 Study Area Spatial Boundaries

The Wetland Regional Study Area (RSA), the Wetland Local Study Area (LSA), Reroute corridor and the Reroute Footprint were the spatial boundaries in which the identification and/or characterization of wetlands were targeted. The definitions and rationale behind these boundaries are discussed further in Appendix F of the Coldwater Reroute ESA.

The Reroute Footprint assumes certain quantitative values for the area that will be directly disturbed by Reroute-specific activities within the defined Footprint , including: a 45 m pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace); temporary access roads (assumed to use existing access, where practical); and valves (assumed to be within the disturbed right-of-way). The Reroute corridor is an approximate 300 m wide band generally centred on the pipeline centreline (*i.e.,* 150 m on both sides). There are select areas where a variable corridor width of up to 400 m was required to accommodate watercourse crossings and or steeper slopes. The corridor approach is used to accommodate potential route realignments and to allow for some flexibility during construction and to avoid environmental and cultural resources, if required, prior to finalizing the Reroute Footprint. The Wetland LSA consists of a 300 m wide band generally from the centre of the proposed pipeline corridor (*i.e.,* 150 m on both sides of the proposed pipeline corridor centre). The Wetland RSA generally aligns with the Aquatics RSA which includes the Lower Nicola Watershed.

3.2 Wetland Definitions and Classification Systems

Wetland definitions and classification methods provided in The Canadian Wetland Classification System (CWCS) (NWWG 1997) and Wetlands of British Columbia: A Guide to Identification (MacKenzie and Moran 2004), under the BC Biogeoclimatic Ecosystem Classification (BEC) system, were used to guide the identification and characterization of wetlands during desktop review and field data collection.

3.2.1 Wetland Definitions

CWCS:

> "…land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment" (NWWG 1997).

Wetlands of BC: A Guide to Identification:

> "…areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development. Wetlands will have a relative abundance of hydrophytes in the vegetation community and/or soils featuring 'hydric' characters" (MacKenzie and Moran 2004).

These definitions encompass a wide range of ecosystems, from semiterrestrial fens, bogs and swamps to semi-aquatic marshes and shallow open-water complexes. Wetlands include a broad range of ecosystem types, from those permanently flooded by shallow water and dominated by aquatic organisms to forested sites with merely moist soils.

3.2.2 Classification of Wetlands, Lakes, and Flood Ecosystems

Wetlands were classified using a hierarchical system based on the CWCS (NWWG 1997). Wetlands were first characterized based on their class (*i.e.,* bog, fen, swamp, marsh and shallow water) and subclass, which relates to the overall nature of the wetland ecosystem, and subsequently wetland form, which relates to the wetland morphology and hydrology. Table 1 provides the CWCS terminology used to describe wetlands by class, subclass and form. Additional details are provided in the Wetland Evaluation Technical Report 5C-8 (Filing ID A3S2I3). The primary characteristics of each wetland class are provided in Table 2, under the equivalent site class.

Under the CWCS, lakes are not considered to be wetlands; they are defined as permanent waterbodies with a depth greater than 2 m (whereas shallow water wetlands/ponds have a depth less than 2 m), usually with a developed profundal zone (*i.e.,* the deep zone of a waterbody that is typically aphotic and does not support vegetation growth). The FPWC does not apply to these features and they are not included in the overall effects assessment for wetlands.

Wetland site associations in the Footprint Study Area were determined during ground-based field work as per the BC BEC system, following Wetlands of British Columbia: A Guide to Identification (MacKenzie and Moran 2004). Table 2 outlines the groups, site classes, site class characteristics and common site associations applicable to wetland classification in the Ponderosa Pine (PP) and Bunchgrass (BG) BEC zones, where the Reroute is located. Note that the “site classes” (*i.e.,* bog, fen, swamp, marsh, and shallow water) described in the BEC system are derived from the wetland classes used in CWCS, therefore the site class characteristics summarized in Table 2 apply to both classification systems. Site associations that are part of the “flood” group (Table 2) were also classified, as they share certain characteristics with wetlands (*e.g.,* they are periodically inundated), and they fall under the same Provincial regulatory framework as wetlands, as they are riparian ecosystems, which are a conservation priority under the BC GEOs. However, flood associations have well-drained soils and do not meet the definition of a wetland (they are considered to be transitional terrestrial ecosystems), therefore the FPWC does not apply to these features and they are not included in the overall effects assessment for wetlands.

The BC Conservation Data Centre (BC CDC) Red- and Blue-listed rare ecological community status was determined for wetlands and flood associations based on their site association, as described in the Vegetation Technical Data Report for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project.

Wetlands and lakes were assigned riparian classes according to the *EPMR*. The riparian class of a wetland or lake determines the width of its RRZ, RMZ and RMA, which can be used to guide avoidance, minimization, mitigation and restoration activities related to these ecosystems. Tables 3 and 4 provide summaries of wetland and lake riparian classification, respectively, which are based on wetland/lake size and BC biogeoclimatic (BGC) unit.

Artificial ponds (*e.g.,* dugouts) are evaluated based on historical satellite imagery (where available) during desktop review and characteristics present during field surveys, such as vegetation and soil development. A dugout may be considered a wetland if it has poorly drained soils, hydrophytic vegetation and various kinds of biological activity which are adapted to a wet environment, although it is artificial. In such cases, the features are included as wetlands in the results. For features that lacked one of key characteristics of a wetland (*i.e.,* well-drained soils), the feature was included as a flood association.

TABLE 1

CANADIAN WETLAND CLASSIFICATION SYSTEM – CLASSES, FORMS AND TYPES

Wetland Classes[1]	Wetland Subclass	Wetland Form[2]
Bog	Treed Shrubby Non-woody	Basin Blanket Flat Mound Plateau Riparian Slope String
Fen	Treed Shrubby Non-woody	Channel Feather Horizontal Riparian Slope Spring String
Swamp	Needle-leaf treed Broad-leaf treed Mixedwood treed Shrubby	Discharge Flat Inland Salt Mineral-Rise Riparian Slope
Marsh and Wet Meadow	Emergent Seasonal Emergent	Basin Hummock Lacustrine Riparian Slope Spring
Lakes and Ponds	Open Water Aquatic Beds Mineral Flats Shores and Low Terraces	Basin Lacustrine Riparian

Source: Modified from NWWG 1997

Notes:
1 The primary characteristics of each wetland class are provided in Table 2 under the equivalent site class.
2 Forms that are not typical for wetlands in the Intermountain Prairie Wetland Subregion, where the Reroute is located, are not included.

TABLE 2

WETLAND BIOGEOCLIMATIC ECOSYSTEM CLASSIFICATION IN THE PONDEROSA PINE AND BUNCHGRASS ZONES

Group	Site Class	Site Class Characteristics	Characteristic Species Groups	Site Association[1]
Freshwater Realm				
Wetland	Bog (Wb)	• Nutrient-poor peatlands (> 40 cm peat) with ericaceous shrubs and hummock-forming Sphagnum species • Highly acidic and oxygen-poor soil (pH < 5.5) • Surface raised above groundwater flow	*Sphagnum* mosses, ericaceous shrubs, and conifers	None described for the PP or BG zones
	Fen (Wf)	• Peat accumulation (> 40 cm peat) • High mineral content at rooting zone due to groundwater inflow (pH > 5.0) • Develop in basins, lake margins, river floodplains and seepages	Deciduous shrubs, sedges, and brown mosses	None described for the PP or BG zones
	Marsh (Wm)	• Mineral soils or well-humified peat • Shallow (0.1 to 2 m) • Fluctuating water table with early season high water levels • Exposure of substrate in late season or during drought • High nutrient availability	Large emergent sedge, grass, forb or horse-tail species	Wm01 Beaked sedge – Water sedge Wm03 Awned sedge Wm04 Common spike-rush Wm05 Cattail Wm06 Great bulrush Wm07 Baltic rush
	Swamp (Ws)	• Mineral soils or well-humified peat • Temporary shallow flooding (0.1 to 1 m) • Water flow from a near-surface water table • High nutrient availability	Conifers, willows, alders, forbs, grasses, and leafy mosses	Ws03 Bebb's willow – Bluejoint
	Shallow water/Pond (Ww)	• Permanent water (0.5 m to 2 m) • Dominated by rooted, submerged, and floating aquatic plants • Still or slow-moving permanent waterbodies • Mineral soils or well-humified peat	Aquatic species, emergent vegetation, < 10% cover	None described for the PP or BG zones
Terrestrial Realm[2]				
Flood	Low bench (Fl)	• Directly adjacent to watercourse • Annual flooding for greater than 21 days • Annual erosion and deposition	Flood-tolerant shrubs	Fl03 Pacific willow – Red-osier dogwood – Horse-tail Fl06 Sandbar willow Fl07 Water birch – Rose
	Mid bench (Fm)	• Elevated • Floods most years for 10 to 21 days • Areas of sedimentation	Flood-tolerant trees and shrubs	Fm01 Cottonwood – Snowberry – Rose Fm02 Cottonwood – Spruce – Red-osier dogwood
	High bench (Fh)	• Above normal water flow • Brief flooding	Upland species of seepage sites	None described for the PP or BG zones

Source: Adapted from Wetlands of British Columbia: A Guide to Identification (MacKenzie and Moran 2004).

Notes: 1 If a wetland vegetation community is observed in the field that is not described for the PP or BG zone, a site association described for another BEC zone may be assigned when accurate. If a wetland vegetation community is observed that is not described at all in MacKenzie and Moran (2004), a site class will be assigned, and the vegetation community recorded on field forms.

2 Groups in the terrestrial realm are not considered to be wetlands; however, the flood group is included in this table because it includes riparian ecosystems, which are conservation priority under the BC GEOs, and they were identified during the wetland field survey.

> = greater than

< = less than

TABLE 3

WETLAND RIPARIAN CLASSIFICATION AND ASSOCIATED RIPARIAN MANAGEMENT AREAS

Wetland Riparian Class	Description	RMA (m)	RRZ (m)	RMZ (m)
W1	Wetland is > 5 ha in size, or if located in the BWBSmw1/BWBSmw2[a] BGC subzone[1], 5 ha to 1,000 ha in size.	50	10	40
W2	Wetland is 0.25 ha to 5 ha in size.	30	10	20
W3	Wetland is > 1,000 ha in size and is located in the BWBSmw1/BWBSmw2 BGC subzone[1].	0	0	0
Unclassified	Wetland is < 0.25 ha in size.	N/A	N/A	N/A

Source: Adapted from the *EPMR* (BC Reg. 200/2010; BC OGC 2018a).

Note: 1 Variant 1 and 2 of the Moist Warm subzone of the Boreal White and Black Spruce zone (DeLong et al. 2011).

TABLE 4

LAKE RIPARIAN CLASSIFICATION AND ASSOCIATED RIPARIAN MANAGEMENT AREAS

Wetland Riparian Class	Description	RMA (m)	RRZ (m)	RMZ (m)
L1-A	Lake is > 1,000 ha in size.	70	50	20
L1-B	Lake is 5 ha to 1,000 ha in size.	40	20	20
L2	Lake is 1 to 5 ha in size and is located within the BG, PP, IDFxh, IDFxw, IDFxm, CDF, CWHdm, CWHds, or CWHxm BGC zone.	30	10	20
L3	Lake is 1 to 5 ha in size and is not located within the BG, PP, IDFxh, IDFxw, IDFxm, CDF, CWHdm, CWHds, or CWHxm BGC zone.	30	0	30
L4	Lake is 0.25 to 1 ha in size and is located in the BG, PP, IDFxh, IDFxw, or IDFxm BGC zone, or the lake is 0.5 to 1 ha in size and is located in the CDF, CWHdm, CWHds, or CWHxm BGC zone.	30	0	30
Unclassified	Lake is < 1 ha and is not located within the BG, PP, IDFxh, IDFxw, IDFxm, CDF, CWHdm, CWHds, or CWHxm BGC zone.	N/A	N/A	N/A

Source: Adapted from the *EPMR* (BC Reg. 200/2010; BC OGC 2018a).

Notes: CDF = Coastal Douglas-Fir

CWHdm, CWHds, and CWHxm = Coastal Western Hemlock, dry maritime, dry submaritime, and very dry maritime IDFxh, IDFxw, and IDFxm = Interior Douglas-fir, very dry hot, very dry warm, or very dry mild

3.3 Desktop Review

The following sections outline methods used for the desktop review of wetland Regional descriptions, satellite imagery and mapping and designated wetland conservation areas.

3.3.1 Wetland Regional Descriptions

Literature describing Canada Wetland Regions (Energy, Mines and Resources Canada 1986), and BC BGC zones (BC MOF 1998a, 1998b) was reviewed to provide general information on the types and abundance of wetlands expected in the Wetland RSA.

3.3.2 Designated Wetland Conservation Areas

A review of the following Federally and Internationally identified areas that are relevant to the conservation of wetland ecosystems was conducted: Important Bird Areas (Bird Studies Canada 2015), Ramsar wetlands (Secretariat of the Convention on Wetlands 2020), Migratory Bird Sanctuaries (Government of Canada 2019), National Wildlife Areas (Government of Canada 2020), and Western Hemisphere Shorebird Reserves (WHSRN 2019).

3.3.3 Satellite Imagery and Mapping Review

Prior to the 2019 Reroute field reconnaissance, satellite imagery was reviewed to identify potential wetlands within a 150 m wide corridor centered on the October 2019 Reroute centreline, to assist in survey site selection. Following provision of the Reroute Footprint and prior to the 2020 Reroute wetland surveys, satellite imagery was reviewed along revised areas of the Reroute and footprint additions (*e.g.*, access roads). Imagery at varying scales (approximately 1:2,000 to 1:20,000) was reviewed to capture temporary or inconspicuous potential wetland features (*e.g.*, flood associations, treed swamps or shrubby swamps). The BC Freshwater Atlas (BC MFLNRORD 2018) was also examined. Wetlands were classified according to the CWCS during desktop review.

3.4 Field Data Collection

Environmental field reconnaissance was conducted from October 22 to 24, 2019 along the centreline of the Reroute, where land access was granted. Wetland communities (as well as any flood associations and lakes) along the reconnaissance segments were field verified for presence.

Wetland field surveys were conducted from July 14 to 19, 2020 to verify remaining wetlands along the Reroute and assess wetland function at all wetlands identified on the Reroute Footprint, as described in subsection 3.4.1. All wetlands on the Reroute Footprint were ground-truthed during field surveys. Three potential flood associations were identified by desktop review that have not been ground-truthed. Detailed information on wetland location, vegetation, hydrology, substrate (*i.e.,* peat or mineral), habitat and existing disturbance was collected. Riparian classifications as per the *EPMR* were determined following field work, based on feature area. For each wetland, the CWCS classification was confirmed or refined, and a site association as per the BEC system was assigned based on the dominant vegetation community (or communities) observed. The vegetation communities present within a given wetland can vary spatially, and thus, multiple site associations may be documented. As a result, there can be slight discrepancies in the site associations assigned to a wetland during wetland field surveys compared to those represented in spatial mapping attributes or assigned to a specific wetland location during other environmental field surveys (*e.g.*, rare plants, rare ecological communities, and wildlife) along the Reroute. Occurrences of rare ecological communities within wetlands and flood associations were also documented. Further details on these communities are provided in the Vegetation Technical Data Report for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project.

Riparian classifications as per the *EPMR* were determined following field work, based on feature area. To help support and inform the field surveys, participants from Esh-kn-am (Coldwater Indian Band, Cooks Ferry Indian Band and Siska First Nation), Scw’exmx Tribal Council (Nooaitch Indian Band, Nicomen Band and Shackan Indian Band), and Lower Nicola Indian Band accompanied the Jacobs field crew to identify environmental, cultural and social resources along the Reroute.

3.4.1 Wetland Landscape Function Assessment

The methodology used for wetland functional assessment are adequate to meet CER Condition 41 as they are based on consultation with Appropriate Government Authorities and literature review as presented in the Technical Report 5C-8, ESA (Volume 5A). A demonstration of the overall adequacy of wetland surveys conducted for the Project was provided in the initial Preliminary Wetland Compensation Plan, provided during the Environmental Assessment process in Q3 2014, and in response to CER Information Request 2.051, which details how the wetland landscape functional assessment is used to compare the pre- and post-construction wetland functional conditions. The landscape functional assessment to be conducted at all wetlands crossed by the pipeline construction footprint prior to construction is adequate to determine each individual functional condition.

The following provides a description of the wetland landscape function assessment methods.

The wetland landscape functional assessment is intended to address several key selected functional components that inform a wetlands' overall functional condition. Although individual wetlands may vary in the types of functions they provide, the selected components apply to most wetlands encountered. This assessment is meant as a generalized tool for assessing some key biophysical (*i.e.*, not socio-economic) functions. The wetland landscape functional assessment was developed for use on TMEP and has been tailored for use along linear disturbances (*i.e.*, pipeline rights-of-way and temporary access roads) as existing literature and available tools did not meet the requirements of assessing wetlands disturbed by pipeline construction during pre-construction surveys and Post-Construction Environmental Monitoring. Wetland landscape function was evaluated using a tiered approach. The first-tier of landscape functions consists of functions that have been identified as being the most important to the surrounding landscape (*e.g.,* water quality and biodiversity) based on a review of existing wetland function assessment literature (Adamus 2011; Ambrose et al. 2009; Fitch et al. 2001; Gilbert et al. 2006; Hanson et al. 2008; Ontario Ministry of Natural Resources 2013). As a result, criteria identified in this first-tier have a heavier weighting. The first-tier landscape functions comprise approximately 54% of the total assessment and generally have a weighting of 16 points each.

Descriptions of the functions identified in the first-tier are provided in Table 5.

TABLE 5

TIER 1 WETLAND LANDSCAPE FUNCTIONS

Wetland Function	Description
Water Quality – Sediment and Nutrient Retention	The effectiveness of a wetland's riparian area to slow down overland flow from the surrounding landscape and lands uses, and retain any suspended sediment and nutrients therefore preventing a flush of contaminants, which could otherwise impact water quality within a wetland and watershed. Assessment of this function depends on the characteristics of the wetland riparian area (*e.g.*, disturbance to riparian area and vegetation characteristics) and the type of surrounding land use (*e.g.,* level of disturbance to surrounding area).
Water Quality – Water Purification	The ability of a wetland to treat incoming water of sediments, nutrients and other contaminants before it is released downstream or into the groundwater. This function can be quantified by considering the occurrence of water entering a wetland (water flow), the length of the flow path through the wetland (wetland surface connectivity) as well as the composition and cover of vegetation (vegetation cover/density).
Biodiversity and Habitat Availability	Wetlands provide a range of habitats for many wildlife and plant species. Due to their unique biogeochemistry, some wetlands are also habitat for rare plants. Additionally, because wetlands often occur as transitions from terrestrial to aquatic environments, they have higher biodiversity than either terrestrial or aquatic environments. Not all wetland types provide the same kind of habitat potential (*e.g.,* marsh versus a bog). As a result, a scoring option for marsh/herbaceous type and woody type wetlands is provided. If the wetland contains herbaceous and woody components, assessment for both types are conducted. An adjustment is then made to the total outcome of the landscape functional assessment to account for both wetland types being assessed.

The wetland functions that make up the second-tier of landscape functions are those that have been identified through a review of the literature as being of moderate importance to the surrounding landscape (*e.g.,* erosion control and flood attenuation). The second-tier landscape functions comprise approximately 27% of the assessment and have a weighting of 12 points each. Descriptions of the functions identified in the second-tier are provided in Table 6.

TABLE 6

TIER 2 WETLAND LANDSCAPE FUNCTIONS

Wetland Function	Description
Substrate Protection	The ability of a wetland to provide substrate protection during high wind or storm events (*e.g.*, increase water inputs). The type of vegetation found within a wetland can influence the ability of the wetland to prevent substrate erosion. A wetland with a diverse plant community (*i.e*., presence of woody and herbaceous vegetation) with little bare soil (*i.e*., less that 1% of the wetland) will provide a larger substrate protection function and score higher than a wetland that has greater that 15% bare soil present.
Flood/Spring Melt Control	The ability and effectiveness of a wetland to retain surface water from heavy storm events as well as spring snow melt. This parameter consists of two components: the presence of artificial impedances or altered wetland, contour disturbances, and the wetlands' water supply capacity.

The third tier of wetland functions are important to the surrounding landscape (*e.g.,* groundwater recharge and climate change) but to a lesser extent, based on review of the literature. Each component of this section of the assessment has a weighting of 8 points each and comprise approximately 18% of the overall assessment. Table 7 provides a description of these functions.

TABLE 7

TIER 3 WETLAND LANDSCAPE FUNCTIONS

Wetland Function	Description
Groundwater Recharge	The effectiveness of a wetland to supply the groundwater table with additional water. This function consists of two components: hydrological connectivity (*i.e.*, surface and subsurface connections) and hydraulic conductivity (*i.e.*, substrate porosity).
Climate Change	The effectiveness of a wetland to store carbon (*i.e.,* a sink). Carbon sequestration in wetlands occurs with peat development and depends on vegetation quality (*i.e.,* ease of decomposition), temperature, water table position, and litter input rates. It should be noted that a wetland that does not accumulate peat can still sequester carbon through high rates of plant productivity but only for very short periods of time.

There are two outcomes of the assessment with respect to the total wetland functions score. Each outcome is dependent on the class characteristics of the wetland being assessed. If the wetland is found to only be dominated by herbaceous plant species (*e.g.*, marsh or non-woody fen) or the wetland is found to only be dominated by woody plant species (*e.g.*, shrubby swamp or treed fen) then the total wetland function score is out of 88. Should the wetland being assessed be determined to be a mixed class complex (*i.e*., presence of both herbaceous plant species dominated [*e.g.*, marsh] and woody plan species dominated [*e.g.,* shrubby swamp]) then total wetland function score is out of 97.

Information on the purpose of assigning a range of scores and corresponding percentages is outlined in the response to CER Information Request No. 2.051b (Filing ID A3Z4T9).

4.0 RESULTS

4.1 Results of Desktop Review

Results of the satellite imagery and mapping was conducted to support field data collection. Results of field data collection are presented in subsection 4.2.

4.1.1 Wetland Regional Descriptions

Wetland regions in Canada are defined by wetland ecosystems that develop in locations with similar topography, hydrology and nutrient regime. The Reroute crosses the Intermountain Prairie Wetland Region. Characteristic wetlands of the Intermountain Prairie Wetland Region include marshes with ephemeral to semi-permanent shallow waters. Peat accumulation is limited within the Intermountain Prairie Wetland Region with most wetlands possessing a mineral substrate (Energy, Mines and Resources Canada 1986).

The Reroute crosses two BGC zones: the PP BGC zone and the BG BGC zone. The PP BGC zone is located in the southern portion of BC and is the driest and warmest of the forest zones and winters are cool with light, intermittent snow cover. Ponderosa pine dominates forested areas with a grassy understory. Wetlands are not common within this zone; however, moisture loving plant species can be found in seepages and in riparian areas (BC MOF 1998a). The BG BGC zone is located in south central BC and lies within the rainshadow of the Coast and Cascade mountains, which results in the BG BGC zone being one of BC’s warmest and driest areas. Many drought tolerant plants and shrubs are found within the BG BGC zone. The most common wetland type found within this zone are marshes dominated by cattail and bulrush species. Saline meadows are also present in shallow basins and associated with ponds and lakes (BC MOF 1998b).

4.1.2 Designated Wetland Conservation Areas

The Reroute does not cross any designated wetland conservation areas. The Reroute is not located within any National Wildlife Areas (Government of Canada 2020), Migratory Bird Sanctuaries (Government of Canada 2019), Important Bird Areas (Bird Studies Canada 2015), Western Hemisphere Shorebird Reserves (WHSRN 2019) or Ramsar wetlands (Secretariat of the Convention on Wetlands 2020).

4.2 Results of Field Data Collection

The results of the environmental field reconnaissance and wetland field survey identified that a total of four wetlands and eight flood associations are encountered by the Reroute Footprint. A total of ten wetlands and nine flood associations are encountered by the Reroute corridor. A total of three wetlands are encountered by the access road footprint. No lakes were encountered. Details regarding wetlands and flood associations encountered by the Reroute Footprint, Reroute corridor, access road footprints are provided in Tables 8 to 10. The distribution of wetlands along the Reroute is shown on Figure 1 and on the Environmental Resource Maps (Appendix G of the Coldwater Reroute ESA).

TABLE 8

REROUTE FOOTPRINT INTERACTIONS WITH WETLANDS AND FLOOD ASSOCIATIONS

ID No.	Wetland Class, Preliminary Site Association and Preliminary BC CDC Rank[1]	AK Range	UTM		Approx. Length Crossed by Footprint (km)	Total Wetland Area (ha)	Wetland Area within Footprint (ha)	BC Riparian Class[2]	Wetland Function (%)
			Start (10N)	End (10N)					
CW_WT-025	Flood Association (Fm01) (Red-listed)	AK 1.01 to AK 1.21	657174E 5548775N	656953E 5548572N	0.20	6.60	1.32	W1	N/A
CW_WT-026	Flood Association (Fm01) (Red-listed)	AK 1.20 to AK 1.39	656954E 5548527N	565753E 5548351N	0.19	1.59	0.89	W2	N/A
CW_WT-027	Flood Association (Fm01) (Red-listed)	AK 1.43 to AK 1.54	656725E 5548318N	565710E 5548187N	0.11	0.81	0.67	W2	N/A
CW_WT-001	Deep Emergent Marsh (Wm05) (Blue-listed)	AK 3.35 to AK 3.37	655008E 5548635N	654987E 5548640N	0.02	0.04	0.01	Unclassified	Low-moderate (48%)
CW_WT-002	Deep Emergent Marsh (Wm06) (Blue-listed)	AK 3.49 to AK 3.51	654858E 5548590N	654842E 5548592N	0.02	0.03	0.03	Unclassified	Low-moderate (38%)
CW_WT-005 (WT-1375)[3]	Flood Association (Fl00[4])	AK 5.25 to AK 5.27	653246E 5549088N	653228E 5549085N	0.02	1.42	0.07	W2	N/A
		AK 5.34 AK 5.43	653169E 5549042N	653059E 5549072N	0.09		0.20		
CW_WT-007	Flood Association (Fl00[4])	AK 8.15 to AK 8.21	651078E 5547591N	651015E 5547589N	0.06	0.42	0.06	W2	N/A
CW_WT-012 (WT-1368)	Wet Meadow (Wm00[4])	AK 9.25 to AK 9.31	650695E 5546585N	650677E 5546531N	0.06	0.37	0.23	W2	High-moderate (52%)
CW_WT-016	Flood Association (Fl07) (Red-listed)	AK 13.39 to AK 13.46	649768E 5542688N	649800E 5542610N	0.07	0.70	0.26	W2	N/A
CW_WT-017	Flood Association (Fl07) (Red-listed)	AK 13.89 to AK 13.93	649652E 5542211N	649641E 5542172N	0.04	1.01	0.01	W2	N/A
		AK 13.91 to AK 13.94	649674E 5542183N	649673E 5542146N	0.04		0.09		
CW_WT-018	Shrubby Swamp (Ws03) (Blue-listed)	AK 13.95 to AK 14.01	649689E 5542138N	649672E 5542079N	0.06	0.04	0.01	Unclassified	Low-moderate (42%)
CW_WT-020	Flood Association (Fm01) (Red-listed)	AK 16.48 to AK 16.69	648864E 5539799N	648865E 5539588N	0.21	8.29	1.00	W1	N/A

Notes:

1 Classifications are according to MacKenzie and Moran (2004) and the Canadian Wetland Classification System (NWWG 1997). BC CDC rank included for wetland/flood association rare ecological communities.

2 Riparian classes, as per the *EPMR* (BC Reg. 200/2010; BC OGC 2018a).

3 Wetland crosses the pipeline route more than once; this feature is shown as separate wetland crossings in this table.

4 Vegetation community observed in the field was not described in MacKenzie and Moran (2004). The site class is indicated here, and the vegetation community is recorded on field forms.

TABLE 9

REROUTE CORRIDOR INTERACTIONS WITH WETLANDS AND FLOOD ASSOCIATIONS

ID No.	Wetland Class, Preliminary Site Association and Preliminary BC CDC Rank[1]	AK Range	UTM		Approx. Length Crossed by Footprint (km)	Total Wetland Area (ha)	Wetland Area within Footprint (ha)	BC Riparian Class[2]	Wetland Function (%)
			Start (10N)	End (10N)					
CW_WT-025	Flood Association (Fm01) (Red-listed)	AK 1.01 to AK 1.21	657199E 5548714N	656897E 5548572N	0.28	6.60	6.02	W1	N/A
CW_WT-026	Flood Association (Fm01) (Red-listed)	AK 1.20 to AK 1.39	657002E 5548506N	565746E 5548356N	0.24	1.59	1.59	W2	N/A
CW_WT-027	Flood Association (Fm01) (Red-listed)	AK 1.43 to AK 1.54	656807E 5548262N	565710E 5548187N	0.12	0.81	0.81	W2	N/A
CW_WT-001	Deep Emergent Marsh (Wm05) (Blue-listed)	AK 3.35 to AK 3.37	655008E 5548635N	654981E 5548654N	0.03	0.04	0.04	Unclassified	Low-moderate (48%)
CW_WT-002	Deep Emergent Marsh (Wm06) (Blue-listed)	AK 3.49 to AK 3.51	654858E 5548590N	654842E 5548592N	0.02	0.03	0.03	Unclassified	Low-moderate (38%)
CW_WT-005 (WT-1375)[3]	Flood Association (Fl00[4])	AK 5.25 to AK 5.49	653246E 5549088N	652984E 5549067N	0.24	1.42	1.42	W2	N/A
CW_WT-006	Shrubby Swamp (Ws03) (Blue-listed)	AK 7.00 to AK 7.07	651875E 5548194N	651813E 5548169N	0.07	0.17	0.17	Unclassified	High-moderate (59%)
CW_WT-007	Flood Association (Fl00[4])	AK 8.10 to AK 8.21	651123E 5547677N	651015E 5547590N	0.11	0.42	0.42	W2	N/A
CW_WT-008	Flood Association (Fl07) (Red-listed)	AK 8.47 to AK 8.68	650863E 5547345N	650790E 5547156N	0.21	0.56	0.56	W2	N/A
CW_WT-010	Deep Emergent Marsh (Wm00[4])	AK 8.73 to AK 8.77	650714E 5547124N	650702E 5547091N	0.04	0.09	0.03	Unclassified	Low-moderate (48%)
CW_WT-011	Deep Emergent Marsh (Wm00[4])	AK 8.86 to AK 8.90	650855E 5546935N	650864E 5546886N	0.04	0.08	0.08	Unclassified	High-moderate (64%)
CW_WT-012 (WT-1368)	Wet Meadow (Wm00[4])	AK 9.25 to AK 9.31	650695E 5546585N	650677E 5546531N	0.09	0.37	0.66	W2	High-moderate (52%)
CW_WT-013	Open Water Pond (Wm05) (Blue-listed)	AK 9.24 to AK 9.33	650555E 5546641N	650517E 5546523N	0.06	1.49	0.37	W2	High-moderate (50%)
CW_WT-014	Seasonal Emergent Marsh (Wm00[4])	AK 10.13 to AK 10.26	650387E 5545752N	650364E 5545619N	0.14	0.33	0.33	W2	Low-moderate (43%)
CW_WT-016	Flood Association (Fl07) (Red-listed)	AK 13.31 to AK 13.46	649729E 5542779N	649800E 5542610N	0.15	0.70	0.70	W2	N/A
CW_WT-017	Flood Association (Fl07) (Red-listed)	AK 13.80 to AK 13.93	649554E 5542323N	649676E 5542171N	0.13	1.01	0.63	W2	N/A
		AK 13.91 to AK 13.94	649674E 5542183N	649673E 5542146N	0.04		0.09		
CW_WT-018	Shrubby Swamp (Ws03) (Blue-listed)	AK 13.94 to AK 14.01	649691E 5542140N	649672E 5542079N	0.06	0.04	0.04	Unclassified	Low-moderate (42%)
CW_WT-020	Flood Association (Fm01) (Red-listed)	AK 16.43 to AK 16.70	648977E 5539883N	648735E 5539558N	0.27	8.29	5.56	W1	N/A
CW_WT-022	Seasonal Emergent Marsh	AK 18.01 to AK 18.05	649020E 5538437N	649058E 5538424N	0.04	0.07	0.07	Unclassified	-

Notes:

1 Classifications are according to MacKenzie and Moran (2004) and the Canadian Wetland Classification System (NWWG 1997). BC CDC rank included for wetland/flood association rare ecological communities.

2 Riparian classes, as per the *EPMR* (BC Reg. 200/2010; BC OGC 2018a).

3 Wetland crosses the pipeline route more than once; this feature is shown as separate wetland crossings in this table.

4 Vegetation community observed in the field was not described in MacKenzie and Moran (2004). The site class is indicated here, and the vegetation community is recorded on field forms.

- = no information available. Wetland was assessed during desktop review.

TABLE 10

REROUTE ACCESS ROAD FOOTPRINT INTERACTIONS WITH WETLANDS AND FLOOD ASSOCIATIONS

ID No.	Wetland Class, Preliminary Site Association and Preliminary BC CDC Rank[1]	Access Road ID	UTM		Approx. Length Crossed by Footprint (km)	Total Wetland Area (ha)	Wetland Area within Footprint (ha)	BC Riparian Class[2]	Wetland Function (%)
			Start (10N)	End (10N)					
CW_WT-013 (WT-1367)	Open-Water Pond (Wm05) (Blue-listed)	8	650583E 5546618N	650606E 5546566N	0.07	1.49	0.04	W2	High-moderate (50%)
CW_WT-012 (WT-1368)[3]	Wet Meadow (Wm00[4])	8	650616E 5546589N	650625E 5546560N	0.03	0.37	0.03	W2	High-moderate (52%)
Merr-Hope_W906point8 (WT-731)[5]	Shrubby Swamp (Ws03) (Blue-listed)	1	657388E 5547634N	657262E 5547539N	0.16	1.06	0.19	W2	High-moderate (69%)

Notes:

1 Classifications are according to MacKenzie and Moran (2004) and the Canadian Wetland Classification System (NWWG 1997). BC CDC rank included for wetland/flood rare ecological communities.

2 Riparian classes, as per the *EPMR* (BC Reg. 200/2010; BC OGC 2018a).

3 Wetland is also encountered by the Reroute Footprint.

4 Vegetation community observed in the field was not described in MacKenzie and Moran (2004). The site class is indicated here, and the vegetation community is recorded on field forms.

5 Wetland survey was conducted during the 2013 wetland field program.

5.0 SUMMARY AND CONCLUSIONS

A total of four wetlands and eight flood associations are encountered by the Reroute Footprint. A total of ten wetlands and nine flood associations are encountered by the Reroute corridor. A total of three wetlands are encountered by the access road footprint. These features are anticipated to experience temporary disturbance from Project activities.

A Provincial approval for Changes In and About a Stream under the *WSA* will be required for wetlands intersected by the Reroute Footprint and should be submitted to the BC OGC. The Project is not anticipated to cause permanent disturbance to wetlands or associated riparian areas, as disturbances associated with pipeline construction, operation and maintenance are temporary, and will be minimized through mitigation which has been prepared to align with Provincial recommendations, and is detailed in the Project-specific EPP (Filing ID C01961). If the Variance Application is approved, Reroute-specific EAS and Resource-Specific Mitigation Tables will be prepared and provided to the CER prior to construction. Therefore, the Federal goal of “no net loss” of wetland function under the FPWC is expected to be achieved. A wetland effects assessment for the Project is presented in subsection 3.2 of the Coldwater Reroute ESA.

Flood associations do not meet the definition of a wetland, therefore the FPWC does not apply to these features and they are not included in the overall effects assessment for wetlands.

6.0 REFERENCES

Adamus, P. 2011. *Manual for the Wetland Ecosystem Services Protocol for the United States*. Accessed March 2013. https://novascotia.ca/nse/wetland/docs/Manual_WESPUS.pdf.

Ambrose, N., G. Ehlert, K. Spicer-Rawe. 2009. *Riparian Health Assessment for Lakes, Sloughs and Wetlands – Field Workbook*. Second Edition. Modified from Fitch, L., B. W. Adams and G. Hale. 2001. *Riparian Health Assessment for Streams and Small Rivers – Field Wordbook*. Lethbridge, Alberta: Cows and Fish Program. 96 pp. Accessed March 2013. https://cowsandfish.org/wp-content/uploads/LakesandWetlandsRHAWorkbook2009.pdf.

Bird Studies Canada. 2015. *Important Bird Areas of Canada Database*. Port Rowan, Ontario: Bird Studies Canada. Accessed July 2020. http://www.ibacanada.org.

British Columbia Ministry of Forests (BC MOF). 1998a. *The Ecology of the Ponderosa Pine Zone*. Victoria, BC. Accessed July 2020. http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro60.pdf.

British Columbia Ministry of Forests (BC MOF). 1998b. *The Ecology of the Bunchgrass Zone*. Victoria, BC. Accessed July 2020. http://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro54.pdf.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2018. *Freshwater Atlas Wetlands* (digital file). Victoria, British Columbia. Current October 4, 2018. Acquired October 4, 2018. https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-wetlands.

British Columbia Oil and Gas Commission (BC OGC). 2018a. *Environmental Protection and Management Guideline*. Version 2.7: December 2018. Accessed June 2020. https://www.bcogc.ca/energy-professionals/operations-documentation/environmental-management/

British Columbia Oil and Gas Commission (BC OGC). 2018b. *Oil and Gas Activities Act*. B.C. Reg. 200/2010. O.C. 435/2010. *Environmental Protection and Management Regulation* [includes amendments up to B.C. Reg. 41/2016, February 29, 2016]. https://www.bclaws.ca/civix/document/id/complete/statreg/200_2010.

DeLong, C., A. Banner, W.H. MacKenzie, B.J. Rogers, and B. Kaytor. 2011. *A Field Guide to Ecosystem Identification for the Boreal White and Black Spruce Zone of British Columbia*. Land Management Handbook Number 65. Victoria, British Columbia: British Columbia Ministry of Forests and Range Research Branch.

Energy, Mines and Resources Canada. 1986. Canada - Wetland Regions [map]. 1:7,500,000. In: *The National Atlas of Canada*. 5th Edition. Fitch, L., B.W. Adams and G. Hale. 2001. Riparian Health Assessment for Streams and Small Rivers – Field Wordbook. Lethbridge, AB: Cows and Fish Program. 90 pp.

Fitch, L., B. W. Adams and G. Hale. 2001. *Riparian Health Assessment for Streams and Small Rivers – Field Wordbook*. Lethbridge, Alberta: Cows and Fish Program. 96 pp. Accessed September 2020. https://cowsandfish.org/wp-content/uploads/LakesandWetlandsRHAWorkbook2009.pdf.

Gilbert, M.C., P.M. Whited, E.J. Clairain and R.D. Smith. 2006. *A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes*. Wetlands Research Program. U.S. Army Corps of Engineers, Engineer Research and Development Center. ERDC/EL TR-06-5.

Government of Canada. 1991. *The Federal Policy on Wetland Conservation*. Cat. No. CW66-116/1991E. Environment Canada, Canadian Wildlife Service, Ottawa, Ontario. 13 pp.

Government of Canada. 2019. *Migratory Bird Sanctuaries*. Accessed July 2020. https://www.canada.ca/en/environment-climate-change/services/migratory-bird-sanctuaries/locations.html.

Government of Canada. 2020. *National Wildlife Areas*. Accessed July 2020. https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/locations.html.

Hanson, A., L. Swanson, D. Ewing, G. Grabas, S. Meyer, L. Ross, M. Watmough, and J. Kirkby. 2008. *Wetland Ecological Functions Assessment: An Overview of Approaches*. Canadian Wildlife Service Technical Report Series No. 497. Atlantic Region. 59 pp.

Lynch-Stewart, P. 1992. *No Net Loss: Implementing "No Net Loss" Goals to Conserve Wetlands in Canada*. Sustaining Wetlands Issues, Paper No. 1992-2. North American Wetlands Conservation Council (Canada). Ottawa, Ontario.

Lynch-Stewart, P., P. Neice, C. Rubec and I. Kessel-Taylor (Environment Canada). 1996. *Federal Policy on Wetland Conservation: Implementation Guide for Federal Land Managers*. Available from the Canadian Wildlife Service, Environment Canada. Ottawa, Ontario.

MacKenzie, W.H. and J.R. Moran. 2004. *Wetlands of British Columbia: A Guide to Identification. Land Management Handbook 52*. British Columbia Ministry of Forests.

National Wetland Working Group (NWWG). 1997. *The Canadian Wetland Classification System*. B.G Warner and C.D.A. Rubec, eds. Waterloo, Ontario: Wetlands Research Centre, University of Waterloo.

Ontario Ministry of Natural Resources. 2013. *Ontario Wetland Evaluation System Southern Manual.* 3rd Edition, Version 3.2. Toronto, ON. 294 p. Accessed August 2020. https://dr6j45jk9xcmk.cloudfront.net/documents/2685/stdprod-103924.pdf

The Secretariat of the Convention on Wetlands. 2020. *Ramsar List - The List of Wetlands of International Importance*. Gland, Switzerland. 55 pp.

Western Hemisphere Shorebird Reserve Network (WHSRN). 2019. *Sites in the Western Hemisphere Shorebird Reserve Network*. Accessed July 2020. https://whsrn.org/whsrn-sites/

APPENDIX D

WILDLIFE AND WILDLIFE HABITAT TECHNICAL DATA REPORT

WILDLIFE TECHNICAL DATA REPORT FOR THE COLDWATER WEST ALTERNATIVE REROUTE FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

September 2020
FINAL
01-13283-S5A-M002-EV-RPT-0009

Prepared for:

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

Jacobs Consultancy Canada Inc.
205 Quarry Park Blvd SE
Calgary, Alberta T2C 3E7
Ph. 403-407-8700

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
°	degree(s)
AK	Alternative Kilometre Post
BC	British Columbia
BC CDC	British Columbia Conservation Data Centre
BC MFLNRORD	British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development
BC OGC	British Columbia Oil and Gas Commission
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
cm	centimetre(s)
Coldwater IR	Coldwater Indian Reserve No. 1
Coldwater Reroute ESA	Environmental and Socio-Economic Assessment for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPCN	Certificate of Public Convenience and Necessity
DBH	diameter at breast height
DPI	Direct Pipe® Installation
EAS	Environmental Alignment Sheet
ECCC	Environment and Climate Change Canada
EPMR	*Environmental Protection and Management Regulation*
EPP	Environmental Protection Plan
ESA	Environmental and Socio-economic Assessment
GWM	General Wildlife Measure
ha	hectare(s)
HDD	horizontal directional drill
km	kilometre(s)
km/hr	kilometre(s) per hour
KP	Kilometre Post
LSA	Local Study Area
m	metre(s)
MBCA	*Migratory Birds Convention Act*
NEB	National Energy Board
OGAA	*Oil and Gas Activities Act*
RSA	Regional Study Area
SARA	*Species at Risk Act*
the Application	Facilities Application under Section 52 of the *National Energy Board Act*
the Approved Route	the route previously-approved by the Canada Energy Regulator - Project corridor that passed to the east of Coldwater Indian Reserve No. 1
the Project or TMEP	Trans Mountain Expansion Project
the Reroute	approximately 18.4 km Reroute of the Project
the West Alternative Route	a western route option that avoided the Coldwater Indian Reserve No.1
Trans Mountain	Trans Mountain Pipeline ULC
UTM	Universal Transverse Mercator
UWR	Ungulate Winter Range
WHA	Wildlife Habitat Areas

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) submitted a Facilities Application under Section 52 of the *National Energy Board Act* (the Application) to the Canada Energy Regulator (CER) (formerly the National Energy Board [NEB]) in December 2013 for the Trans Mountain Expansion Project (the Project or TMEP). A Certificate of Public Convenience and Necessity (CPCN) was issued by the CER on June 21, 2019.

Trans Mountain is proposing an approximately 18.4 km Reroute (the Reroute) from the current Project routing in proximity to the Coldwater Indian Reserve No. 1 (Coldwater IR) in British Columbia (BC) (Figure 1). A western route option that avoided the Coldwater IR (the West Alternative Route) was considered during early Project planning, however was ultimately not selected as a preferred route (refer to Section 4.2 of the original Environmental and Socio-economic Assessment [ESA] [Filing ID A3S1L4]).

Coldwater Indian Band has suggested that a refined West Alternative Route be considered, and Trans Mountain committed to conducting a feasibility study in response to concerns raised by Coldwater Indian Band regarding the route previously-approved by the CER (the Approved Route). The approximately 18.4 km long Reroute deviates from the Approved Route at KP 931.36, re-joining at KP 946.88 (Figure 1). The Reroute was not included in the approved pipeline corridor; therefore, an Application for Variance under Section 190 of the *Canadian Energy Regulator Act* (*CER Act*) is required to vary the CPCN to reflect changes to the previously-approved Application.

Trans Mountain is proposing two trenchless crossings of the Coldwater River – one at the north end and one at the south end of the Reroute. In the Western Feasibility Study, filed in April 2020, Trans Mountain put forward plans to use a horizontal directional drill (HDD) crossing method for both crossings. Since that time, and with the benefit of additional geotechnical drilling results, Trans Mountain has decided to implement alternate trenchless construction methods for the northern crossing due to challenging geotechnical conditions in that area. These alternative and preferred methods are by Direct Pipe® Installation (DPI) and, as a contingency should the DPI prove infeasible, micro-tunnelling. Trans Mountain's primary considerations are to install the crossing in a manner that avoids disturbance to the Coldwater River, while also reducing the technical risks of the crossing based on the geotechnical conditions.

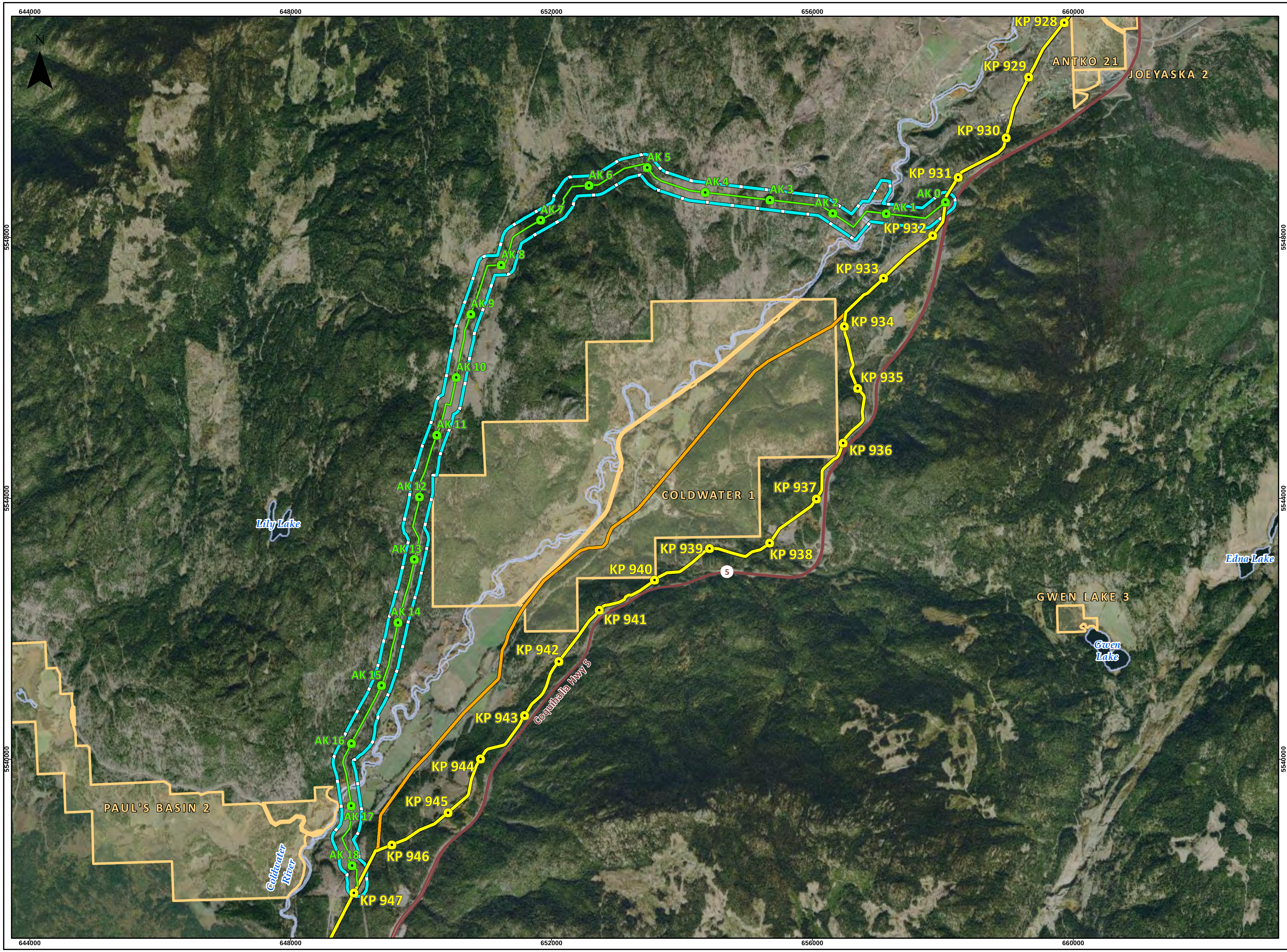
Trans Mountain commissioned Jacobs Consultancy Canada Inc. (Jacobs) to complete a wildlife effects assessment and associated desktop review and field data collection, including a field reconnaissance in October 2019 and wildlife surveys in June 2020, for the Reroute to support the preparation of an ESA for the Reroute. AEW LP was also commissioned by Trans Mountain to complete the June 2020 wildlife surveys in conjunction with Jacobs.

The objective of the field data collection completed for the Reroute was to describe the existing conditions for wildlife and wildlife habitat through:

- Identifying and recording wildlife species within or near the Reroute corridor, including species at risk (refer to subsection 3.2.1 for the definition of these species).
- Identifying wildlife habitat features (*e.g.,* stick nests, dens) important to wildlife that may be affected by the Reroute.
- Reviewing the biophysical attributes of critical habitat for Williamson's sapsucker.

The information collected from the desktop review, field reconnaissance in October 2019 and wildlife surveys in June 2020 was used to inform the assessment of potential adverse effects for wildlife, and to support the implementation of technically and economically feasible mitigation to reduce potential effects on wildlife and wildlife habitat. The potential residual and cumulative effects of the Project on wildlife and wildlife habitat, including an evaluation of significance, are presented in Section 7.2.8 of Volume 5A [Filing ID A3S1Q9], Section 8.7 of Volume 5A [Filing ID A3S1R2], an ESA Update [Filing ID A4F4Z3], Responses to Information Request No. 2.041 [Filing ID A3Z4T9], and Response to Information Request No. 3.025 [Filing ID A4H1V2].

Mitigation measures to be applied for wildlife and wildlife habitat are provided in the Project-specific Pipeline Environmental Protection Plan (EPP) (Filing ID C01961). Environmental Resource Maps are provided in Appendix G of the ESA for the Coldwater Reroute for the Trans Mountain Pipeline ULC Trans Mountain Expansion Project (Coldwater Reroute ESA) clearly depicting the Reroute and summarizing the pertinent environmental information gathered during desktop review and field data collection completed to date. If the Variance Application is approved, Environmental Alignment Sheets and Resource-Specific Mitigation Tables will be provided to the CER prior to construction.



TRANS MOUNTAIN

FIGURE 1

OVERVIEW OF THE COLDWATER WEST ALTERNATIVE REROUTE

PROPOSED TRANS MOUNTAIN PIPELINE ULC

●	Coldwater Reroute Kilometre Post (AK)
●	TMEP Pipeline Kilometre Post (KP)
🟩	Coldwater Reroute
🟨	TMEP Pipeline
🟧	Existing TMPL Pipeline
①	Highway
▭	Coldwater Reroute 300m Corridor
▭	Indian Reserve
▭	Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 8, 2020; Transportation: BC MFLNRO 2012; Hydrology: BC MFLNRO 2008; First Nation Lands: Government of Canada 2018; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

MAP NUMBER
202008_MAP_CH2M_GEN_01194_REV2_FIG1

DATE September 2020	REFERENCE CE771600	REVISION 2
SCALE 1:55,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SAB	CHECKED DJN	DESIGN CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

2.0 REGULATORY CONTEXT

Regulatory guidance on Federal and Provincial standards, legislation and approvals applicable to the interaction of Reroute activities with wildlife is provided as follows.

2.1 Federal Standards

2.1.1 Species at Risk Act

The *Species at Risk Act* (*SARA)* protects species listed as Extirpated, Endangered and Threatened on Schedule 1 of the *Act*. Species included on Schedule 1 are established by the Federal Cabinet and are based on recommendations by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and consultation with government, Indigenous groups and the public. *SARA* applies to Federal lands; however, it may also apply to other lands when Provincial protection is deemed inadequate by the Federal Minister of the Environment.

SARA also applies to all lands in Canada for Schedule 1 bird species cited in the *Migratory Birds Convention Act*. Prohibitions included in *SARA* make it an offence to kill, harm, harass, capture or take an individual of a species listed as Endangered, Threatened or Extirpated on Schedule 1. The prohibitions also make it an offence to possess, collect, buy, sell, or trade an individual or damage/destroy the residence (*e.g.,* a nest or den) of one or more individuals of a species listed on Schedule 1.

Measures to protect and recover a listed wildlife species are to be outlined in a Recovery Strategy or Action Plan for Endangered and Threatened species listed under Schedule 1, and a Management Plan for species listed as Special Concern under Schedule 1. For Endangered and Threatened species, the Recovery Strategy or Action Plan must identify critical habitat, which is the habitat necessary for the survival or recovery of the species. *SARA* prohibits destruction of any part of critical habitat of Endangered or Threatened species without a permit.

Species that were designated at risk by COSEWIC before the creation of *SARA* must be re-assessed according to the criteria of *SARA* before they can be added to Schedule 1. These species are listed on Schedules 2 and 3 and are not yet officially protected under *SARA*.

Project-specific information about wildlife species at risk, including Federally identified critical habitat, and species of special conservation status are provided in the methods and results sections of this Technical Data Report.

2.1.2 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (*MBCA*) protects migratory birds and their habitat in Canada. Environment and Climate Change Canada (ECCC) administers the *Act* through the Canadian Wildlife Service. The *MBCA* allows for regulations to be made by the Governor in Council that prohibit “the killing, capturing, injuring, taking or disturbing of migratory birds or the damaging, destroying, removing or disturbing of nests”. The *MBCA* also protects migratory bird habitat and prescribes for the control and management of the habitat. Under the *MBCA*, no person shall “disturb, destroy, or take a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird”, except when authorized with a permit.

2.2 Provincial Standards

2.2.1 British Columbia Wildlife Act

The BC *Wildlife Act* protects all vertebrate wildlife species (*i.e.*, mammals, birds, amphibians, and reptiles) from direct harm except as allowed under regulation (*e.g.*, legal hunting and trapping). A species may be legislated as Endangered or Threatened under the *Wildlife Act* by the Lieutenant Governor in Council. Under Section 34 of the *Wildlife Act*, a person commits an offence if, except as allowed by regulation, they possess, take, injure, molest or destroy a bird or its egg, the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl or any bird nest that is occupied by a bird or its egg.

Potential Project activities that would require *Wildlife Act* permits include:

- Nest Removal Permit – required if construction activities involve the removal of a nest that has year-round protection under the *Wildlife Act* (*i.e.*, eagle, peregrine falcon, gyrfalcon, osprey, heron or burrowing owl)
- Amphibian/Reptile Salvage Permit – required if construction activities occur during the active season for amphibians or reptiles, and individuals are found within work areas
- Beaver Dam Removal Permit – required if construction activities involve the removal or alteration of a beaver dam

In BC, the BC Conservation Data Centre (BC CDC) assigns each species to either a Red, Blue or Yellow list to help identify the level of concern about their risk and to set conservation priorities. Red- and Blue-listed species are not protected by specific legislation; however, these lists help to identify species that can be considered for designation as Endangered or Threatened under the BC *Wildlife Act*. Any species that is at “risk of being lost” (*e.g.,* Extirpated, Endangered or Threatened) is assigned to the Red list. Species that are of Special Concern are assigned to the Blue list while Species of Least Risk are assigned to the Yellow list (BC CDC 2020b).

2.2.2 British Columbia Oil and Gas Activities Act and Environmental Protection and Management Regulation

The *Oil and Gas Activities Act* (*OGAA*) and associated *Environmental Protection and Management Regulation* (*EPMR*) include protections for wildlife and wildlife habitats. These are administered by the BC Oil and Gas Commission (BC OGC), which is responsible for permitting oil and gas development projects in BC. The BC OGC’s *OGAA* regulates oil and gas and related activities in BC, including wells, facilities, oil refineries, natural gas processing plants, pipelines, and oil and gas roads, through permits, authorizations, orders and regulations.

Under the *OGAA*, the *EPMR* establishes the Provincial government’s environmental objectives for water, riparian habitats, wildlife and wildlife habitat, old-growth forests and cultural heritage resources (the key environmental objectives are identified under Part 2 of the *EPMR*).

The *EPMR* only applies to Crown land and does not apply to private land or to subsurface oil and gas activities associated with an operating area (defined in the *EPMR* as a seismic line, wellsite, facility area, road right-of-way and pipeline corridor) (BC OGC 2018). For Crown land applications, the BC OGC applies the tests and principles of the *EPMR* to ensure proposed activities are in alignment with the statutory requirements and the government’s environmental objectives, including wildlife habitat features and areas, and Ungulate Winter Ranges (UWRs) (BC OGC 2018, 2019). The BC OGC has the authority to deny a permit or authorization or impose conditions on the permit that they consider necessary to meet the intent of the government’s environmental objectives (BC OGC 2018).

UWRs and Wildlife Habitat Areas (WHAs), were initially designated under the *Forest Practices BC Act* to conserve and manage important habitat for species at risk, regionally important wildlife and areas necessary to meet winter habitat requirements for certain ungulate species. Designated WHAs and UWRs were subsequently adopted under the *Forest and Range Practices Act*, and also apply to the *EPMR* under *OGAA*. Legal Orders for designated WHAs and UWRs include General Wildlife Measures (GWMs).

Oil and gas activities regulated by BC OGC under *OGAA* are expected to adhere to applicable GWMs for designated UWRs and WHAs. Section 6 of the *EPMR* prescribes objectives for the management and protection of wildlife and wildlife habitat, including WHAs and UWRs, as well as wildlife tree retention areas and wildlife habitat features. The *EPMR* states that activities should not take place within certain designated wildlife habitats, including WHAs and UWRs, unless the activities will not have a material adverse effect on the wildlife habitat and species for which these areas were established. Additionally, the *EPMR* states that activities outside of a WHA should be scheduled to occur during a time and manner that will not result in the physical disturbance to high priority wildlife or their habitat (including avoiding disturbance during sensitive seasons and critical life stages), and activities should not damage or render ineffective a wildlife habitat feature (as defined in an order under Section 6 of the *EPMR*).

3.0 METHODS

This section contains a summary of the methods and data sources used to conduct the desktop review and wildlife field data collection.

The desktop review and wildlife field data collection consider wildlife species at risk and species of special conservation status, in addition to the more common or abundant species that comprise the broader wildlife community expected to occur in the Reroute study areas, including species having traditional importance (*e.g.*, hunted or trapped species).

3.1 Study Area Spatial Boundaries

The Reroute Footprint, Reroute corridor, Wildlife and Wildlife Habitat Local Study Area (LSA), Wildlife and Wildlife Habitat Regional Study Area (RSA) were the spatial boundaries considered for the assessment of Wildlife and Wildlife Habitat. The definitions and rationale behind these boundaries are discussed further in Appendix F of the Coldwater Reroute ESA.

The Reroute Footprint assumes certain quantitative values for the area that will be directly disturbed by Reroute-specific activities within the defined Footprint, including: a 45 m pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace); temporary access roads (assumed to use existing access, where practical); and valves (assumed to be within the disturbed right-of-way). The Reroute corridor is an approximate 300 m wide band generally centred on the pipeline centreline (*i.e.*, 150 m on both sides). There are select areas where a variable corridor width of up to 400 m was required to accommodate watercourse crossings and or steeper slopes. The corridor approach is used to accommodate potential route realignments and to allow for some flexibility during construction and to avoid environmental and cultural resources, if required, prior to finalizing the Reroute Footprint. The Wildlife and Wildlife Habitat LSA includes a 1 km buffer on both sides of the pipeline centreline. The Wildlife and Wildlife Habitat RSA includes a 15 km buffer on both sides of the pipeline centreline.

The wildlife desktop review focused on the Wildlife and Wildlife Habitat LSA, including associated access roads. Field reconnaissance and wildlife surveys were focused along the centreline and adjacent areas up to 500 m from centreline (depending on survey type and habitat suitability, and in consideration of recommended species-specific setbacks; see field data collection methods), current at the time surveys were conducted. The Reroute Footprint was used to provide area metrics to describe specific wildlife areas.

3.2 Desktop Review

Primary sources of information that were reviewed prior to the wildlife surveys, and used in the preparation of this report, include:

- Federally identified areas of critical habitat (ECCC 2019)
- Provincially identified wildlife areas (*e.g.,* caribou range and Local Population Units [BC MOE 2010; Environment Canada 2014]); proposed or approved UWR (BC MFLNRORD 2019c, 2019d); proposed or approved WHAs (BC MFLNRORD 2019e, 2020b); and Grizzly Bear Population Units (BC MFLNRORD 2020a)
- BC CDC occurrence records (BC CDC 2020a,b)
- Parks and Protected Areas (BC Parks 2020)
- National Wildlife Areas (Government of Canada 2020) and Migratory Bird Sanctuaries (Government of Canada 2019a)
- Important Bird Areas (Bird Studies Canada 2015)
- Western Hemisphere Shorebird Reserves (WHSRN 2019)
- Ramsar Wetlands (The Secretariat of the Convention on Wetlands 2020)

3.2.1 Species at Risk and Species of Special Conservation Status

Species at risk are those species listed Federally on Schedule 1 of the *SARA* (Government of Canada 2019b) or by the COSEWIC (2019). Species of special conservation status include species with Provincial conservation designations, including species designated as Red- or Blue-listed (BC CDC 2020a) or listed Provincially under the BC *Wildlife Act* (BC CDC 2020a), that are not also listed Federally on Schedule 1 of the *SARA* or by the COSEWIC.

Wildlife species at risk that have the potential to occur near the Reroute are presented in subsection 4.1.3. A comprehensive list of both wildlife species at risk and species of special conservation status that have the potential to occur near the Reroute are presented in Appendix A, along with definitions of each conservation status. Provincial ranks assigned by the BC CDC (2020a), including S1 to S3, and designations as priority 1 or 2 by the BC Conservation Framework (BC MOE 2009, 2011) are also included for each wildlife species at risk and species of special conservation status.

The comprehensive list of species at risk and species of special conservation status presented in Appendix A was prepared using the BC Species and Ecosystems Explorer (BC CDC 2020a) with a search criteria to include wildlife species identified as having the potential to occur within both the Cascades Forest District and any of the Bunchgrass, Ponderosa Pine and Interior Douglas-fir Biogeoclimatic Zones, in which the Reroute is located.

The list generated by the BC Species and Ecosystems Explorer was refined based on available information from the Reroute area, known species ranges, species habitat requirements and professional judgment supported by scientific literature (Banfield 1974; BC CDC 2020a; BC MOE 2009, 2011; Campbell et al. 1990; COSEWIC 2019; Corkran and Thoms 1996; Government of Canada 2019b; Matsuda et al. 2006; NatureServe 2020; Stebbins 1966).

3.3 Field Data Collection

A summary of wildlife field data collection completed for the Reroute is presented in Table 1, and the locations of spring 2020 wildlife survey sites are shown on Figures 2 and 3.

TABLE 1

SUMMARY OF FIELD DATA COLLECTION COMPLETED FOR THE REROUTE

Survey Type	Survey Dates	Total Number of Survey Sites Completed
Field reconnaissance	October 22 to 24, 2019	n/a
Amphibian time-constrained search/auditory	June 8 to 15, 2020	7 (diurnal time-constrained searches only) 2 (both diurnal time-constrained searches and auditory surveys)
Williamson's sapsucker call playback	June 8 to 12, 2020	32
Williamson's sapsucker biophysical attribute review	June 9 to 15, 2020	n/a
Common nighthawk call playback/short-eared owl point count	June 9 to 11, 2020 and June 17 to 18, 2020	18
American badger/reptile habitat feature search	June 8 to 13, 2020	n/a
Flammulated owl/western screech-owl call playback	June 9 to 12, 2020 and June 17 to 18, 2020	18 (flammulated owl) 2 (western screech-owl)
Spotted bat habitat reconnaissance	June 12, 2020	1

3.3.1 Fall 2019 Field Reconnaissance

A field reconnaissance was completed from October 22 to 24, 2019 along the Reroute corridor within areas of representative habitat, including AK 4.07 to AK 5.41 (1.34 km), AK 8.12 to AK 8.22 (0.10 km), AK 8.46 to AK 9.51 (1.05 km), AK 9.95 to AK 10.24 (0.29 km), AK 10.63 to AK 11.42 (0.79 km) and AK 11.83 to AK 16.68 (4.85 km) for a total length of approximately 9.86 km (54% of the Reroute).

The field reconnaissance included ground searches to identify wildlife habitat features (*e.g.,* stick nests, mineral licks and dens) important to wildlife that may be affected by the Reroute and a high level review of habitat suitability for species at risk, including the biophysical attributes of critical habitat for Williamson's sapsucker (*e.g.,* suitable nest trees, live trees for foraging and cover, and colonies of aphid-tending ants for foraging) in areas that cross critical habitat identified by ECCC. The presence or absence of each biophysical attribute identified during the field reconnaissance was based on the centreline and immediately adjacent areas. Methods were based on the Williamson's Sapsucker and Lewis's Woodpecker Mitigation and Habitat Restoration Plan that was prepared to address the requirements of CER Condition 44 for the TMEP (Filing ID A90906).

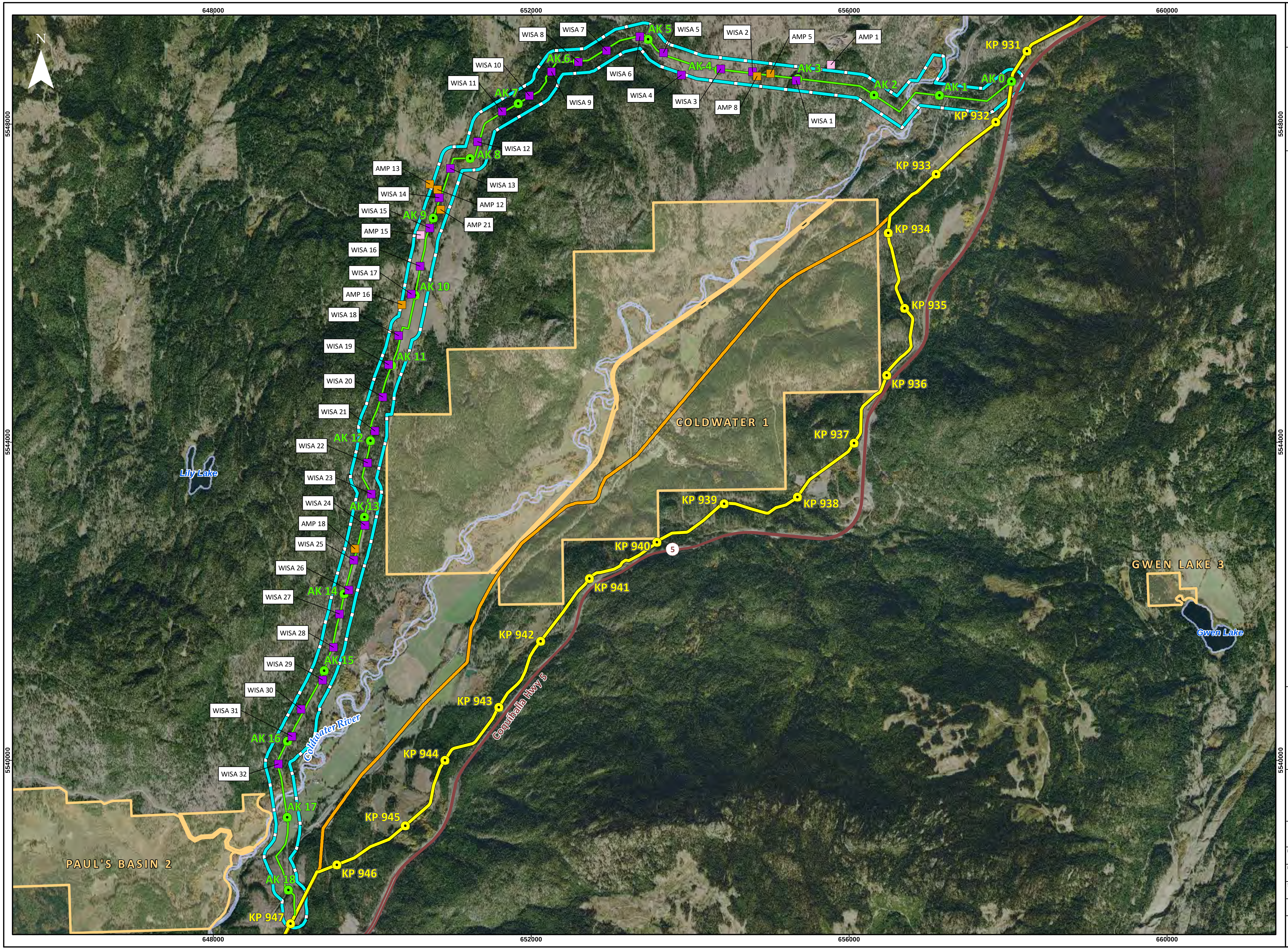
To help support and inform the field reconnaissance, participants from Scw'exmx Tribal Council (Nooaitch, Shackan), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry, Coldwater Indian Band, Siska) accompanied the field crew to identify environmental, cultural and social resources along the Reroute.

3.3.2 Spring 2020 Wildlife Surveys

Wildlife surveys were completed between June 8 and 18, 2020, and were focused along the Reroute centreline and adjacent areas, as described in the following subsections. Surveys were completed by Qualified Environmental Professionals with experience in the surveys being conducted and the wildlife and wildlife habitat with potential to occur in the region.

All incidental wildlife observations (*e.g.,* visual/auditory), evidence of wildlife use, and wildlife habitat features (*e.g.,* stick nests, dens, mineral licks, hibernacula or roosts) were recorded during the wildlife surveys and when traveling to and from survey locations. Where possible, information recorded for each observation included the date, time, species, number, age and sex, general habitat description and GPS location.

To help support and inform the wildlife surveys, participants from Scw'exmx Tribal Council (Nooaitch, Shackan), Lower Nicola Indian Band and Esh-kn-am (Cooks Ferry, Coldwater Indian Band, Siska) participated in the field surveys.



TRANS MOUNTAIN

FIGURE 2

WILDLIFE SURVEY SITES - AMPHIBIANS AND WILLIAMSON'S SAPSUCKER

PROPOSED TRANS MOUNTAIN PIPELINE ULC

COLDWATER WEST ALTERNATIVE REROUTE

- 🟧 Amphibian Time-Constrained Search
- ◻ Amphibian Time-Constrained Search and Auditory Survey
- 🟪 Williamson's Sapsucker Call Playback
- ● Coldwater Reroute Kilometre Post (AK)
- ● TMEP Pipeline Kilometre Post (KP)
- — Coldwater Reroute
- — TMEP Pipeline
- ① Highway
- — Existing TMPL Pipeline
- ▭ Coldwater Reroute 300m Corridor
- ▭ Indian Reserve
- ▭ Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 08, 2020; Transportation: BC MFLNRO 2015; Hydrology: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

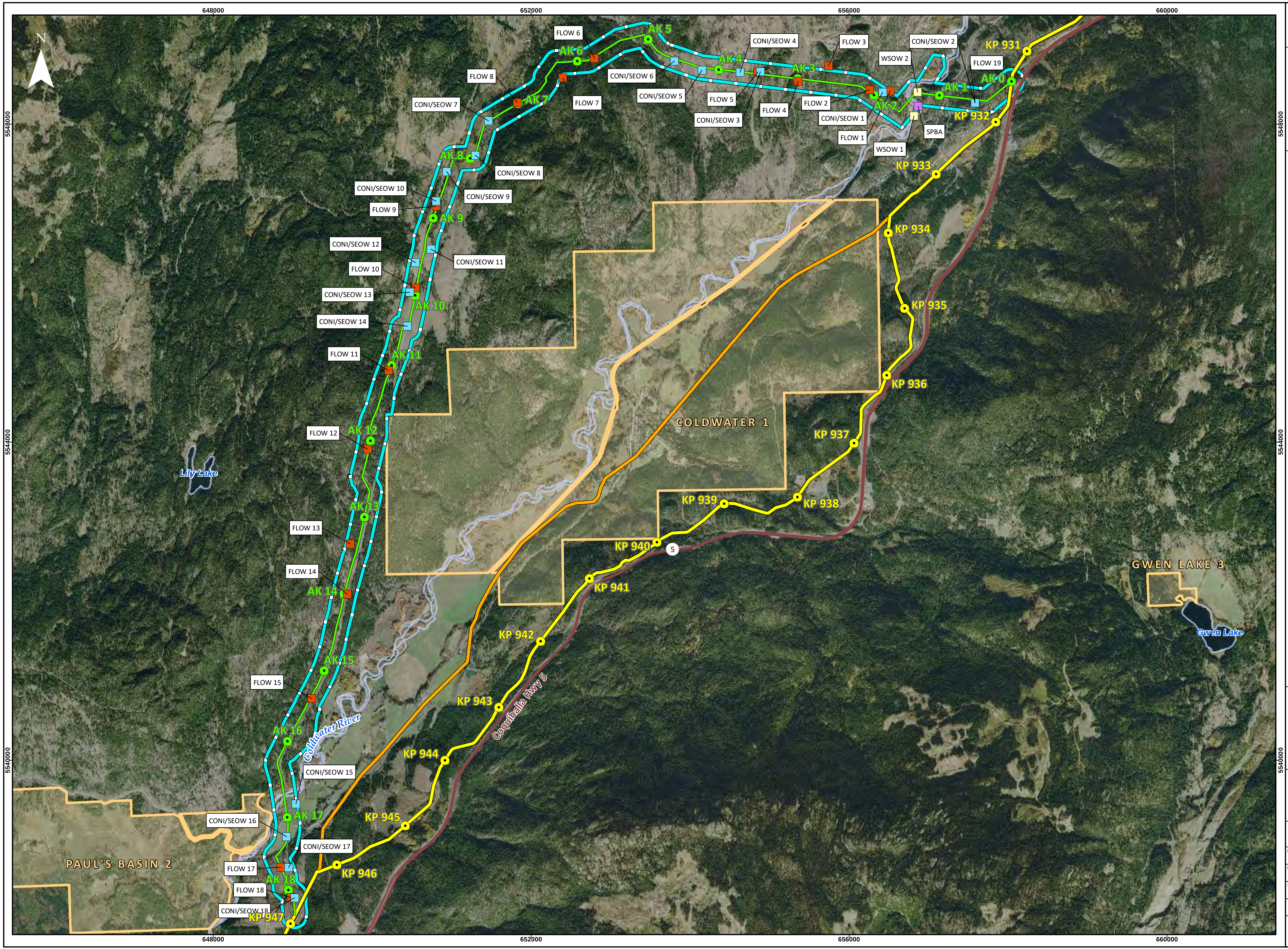
MAP NUMBER
202007_MAP_CH2M_WL_01189_REV1_FIG2

DATE September 2020	REFERENCE CE771600	REVISION 1
SCALE 1:45,000	PAGE SIZE 11x17	DISCIPLINE WL
DRAWN SAB	CHECKED DJN	DESIGN CMR

0 500 1,000 1,500 Metres

ALL LOCATIONS APPROXIMATE

202007_MAP_CH2M_WL_01189_Rev1_Fig2.mxd



TRANS MOUNTAIN

FIGURE 3

WILDLIFE SURVEY SITES - COMMON NIGHTHAWK, OWLS, AND SPOTTED BAT

PROPOSED TRANS MOUNTAIN PIPELINE ULC
COLDWATER WEST ALTERNATIVE REROUTE

- 🟦 Common Nighthawk / Short-eared Owl Survey
- 🟥 Flammulated Owl Survey
- 🟪 Spotted Bat Habitat Reconnaissance
- 🟨 Western Screech-owl Survey
- ● Coldwater Reroute Kilometre Post (AK)
- ● TMEP Pipeline Kilometre Post (KP)
- — Coldwater Reroute
- — TMEP Pipeline
- ① Highway
- — Existing TMPL Pipeline
- ▭ Coldwater Reroute 300 m Corridor
- ▭ Indian Reserve
- ▭ Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI; September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 08, 2020; Transportation: BC MFLNRO 2015; Hydrology: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202007_MAP_CH2M_WL_01189_REV1_FIG3

DATE September 2020	REFERENCE CE771600	REVISION 1
SCALE 1:45,000	PAGE SIZE 11x17	DISCIPLINE WL
DRAWN SAB	CHECKED DJN	DESIGN CMR

0 500 1,000 1,500 Metres

ALL LOCATIONS APPROXIMATE

202007_MAP_CH2M_WL_01189_Rev1_Fig3.mxd

3.3.2.1 Amphibian Surveys

Time-Constrained Searches

Pond-dwelling amphibian survey protocols followed the time-constrained search protocols outlined in the Inventory Methods for Pond-Breeding Amphibians and Painted Turtle (BC MELP 1998c), except for repeat visits (survey sites were visited once for time-constrained searches, though two sites also had auditory surveys; refer to subsection 4.2.2). The Inventory Methods for Pond-Breeding Amphibians and Painted Turtle identify time-constrained searches as the most effective technique for determining presence/non-detection of amphibian species within a specific area. This technique also provides the number of individuals per unit of search effort and eliminates the bias of clustered populations.

Preliminary locations of amphibian surveys were determined based on preliminary wetland delineation, results of the fall 2019 field reconnaissance and review of aerial imagery. Pond-dwelling amphibian surveys were conducted at select wetlands located up to 250 m from the Reroute centreline that have potentially suitable breeding habitat for amphibians, with focus on Great Basin spadefoot habitat requirements, as determined by the biologists in the field. Preliminary locations of amphibian surveys that did not have suitable breeding habitat for amphibians (*e.g.,* no water present) were not surveyed. Additional wetlands encountered during the wildlife surveys that had suitable breeding habitat for amphibians were also surveyed.

Pond-dwelling amphibian surveys were conducted at a total of nine sites (Figure 2) and completed during daylight hours, under satisfactory weather conditions, including good visibility, little or no precipitation, and winds less than 20 km/hr. Biologists circumnavigated the wetlands, searching for evidence of breeding (*i.e.,* egg masses, tadpoles, and young-of-year), and for juveniles and adults. The search included the shoreline and first 3 m of water, unless the water was shallow enough and substrates allowed to search the entire wetland. Observers walked slowly and stopped every few minutes to conduct thorough searches, including scanning the water's surface, the pond bottom, and vegetation and debris. Each selected wetland was searched for a maximum of two person hours (*e.g.*, two people searching for 1 hour). If a wetland was too large to be completely searched in one hour, then at least two 50 m transects were searched in representative areas of the wetland.

Amphibians seen or heard were identified to species, where possible. The areas searched and waypoints were recorded for each survey site or start and end points of each transect. Additional information recorded at each site included the date, the start and end time, weather conditions and a description of the habitat.

Amphibian Auditory Surveys

Nocturnal auditory surveys were intended to be conducted for Great Basin spadefoot at sites identified during the diurnal time-constrained searches as suitable for breeding; however, no suitable Great Basin spadefoot breeding habitat was identified. Therefore, nocturnal auditory surveys for amphibians were completed opportunistically at select wetlands identified as having suitable breeding habitat for other amphibians. Nocturnal auditory survey protocols followed the Inventory Methods for Pond-Breeding Amphibians and Painted Turtle (BC MELP 1998c), except for repeat visits (auditory surveys were conducted in one visit).

Nocturnal auditory surveys were conducted at two sites (Figure 2) and completed between half an hour after sunset and midnight. Observers positioned themselves at a good vantage point to observe the surrounding habitat. A 1-minute quiet period was observed upon arrival to the wetland, followed by a 15-minute listening period. Auditory observations were assigned a calling index from 0 to 3 (Table 2).

TABLE 2

AMPHIBIAN CALLING INDEX

Calling Index	Observed Level of Calling
0	No calls
1	Individuals calling can be counted (*i.e.*, no overlapping calls)
2	Calls of individuals are distinguishable, but with some overlap
3	Full chorus/continuous calling; individuals cannot be distinguished

Source: BC MELP 1998c

Amphibians seen or heard were identified to species, where possible. Additional information recorded at each site included the date, the start and end time, GPS location, weather conditions and a description of the habitat and any site-specific features.

3.3.2.2 Williamson's Sapsucker

Call Playback Surveys

Call playback surveys for Williamson's sapsucker were completed where the Reroute interacts with critical habitat for Williamson's sapsucker and WHAs for Williamson's sapsucker. Survey protocols follow the methods outlined in the Inventory Methods for Woodpeckers (BC MELP 1999b) and the Forest Investment Account Activity Standards Document (BC MOE 2006). Survey methods and locations were discussed and agreed upon with British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). Preliminary sites were spaced at least 400 m apart. The biologists in the field determined if the survey distance in some locations required reductions to account for terrain and dense forested habitat.

Call playback surveys were conducted at a total of 32 sites (Figure 2) and completed from one half hour after sunrise until noon and were only conducted during suitable weather conditions (wind speed < 12 km/hr, temperature between 7°C and 28°C, no heavy precipitation). One call playback was conducted per site, using the following sequence:

- 1-minute quiet period upon arrival to each survey site to listen for the target species and to allow for disturbances in accessing the site to subside
- if the target species is not heard during the quiet period, broadcast Williamson's sapsucker call for 20 seconds followed by 30 seconds of silence, turning the caller 120° between each broadcast
- repeat call sequence three times if no response is detected
- stop the call sequence if a response is elicited, and record the distance and direction to the response to assist with locating a potential nest
- if no response is detected from the calls, broadcast the drumming sequence following the same format as the call broadcast
- once both calls and drumming broadcasts are complete, observe for a 2-minute quiet period before moving to the next station

In addition to the call playbacks, surveyors visually scanned habitat at and while traveling between call playback stations for sign of Williamson's sapsucker. Wildlife trees and woodpecker/sapsucker sign observed at survey sites and between sites were recorded. Additional information recorded at each site included the date, the start and end time, GPS location, weather conditions and a description of the habitat and any site-specific features.

Field Review of Biophysical Attributes of Critical Habitat

A field review of the biophysical attributes of critical habitat for Williamson's sapsucker was completed where the Reroute interacts with critical habitat for Williamson's sapsucker, as identified by ECCC, and WHAs for Williamson's sapsucker. The presence or absence of each biophysical attribute (*i.e.*, suitable nest trees, live trees and ant colonies, see as follows) along the Reroute centreline and adjacent areas was recorded (note, minimum patch size and number of suitable nest trees per territory were not considered since these are difficult to measure in the field). This information will also be used to identify site-specific locations for implementation of mitigation and monitoring measures. Additional information recorded during the surveys includes the date, start and end time, weather conditions, and wildlife habitat features for other species.

Critical habitat, as defined by the *SARA*, is the habitat that is necessary for the survival or recovery of a listed wildlife species and is identified in the Recovery Strategy or Action Plan for that species. All of the required attributes for Williamson's sapsucker must be present within 500 m of each other for an area to be considered critical habitat (*i.e.,* a group of potential nest trees with no live trees or any nests within 500 m is not critical habitat) (ECCC 2016). The biophysical attributes of critical habitat for Williamson's sapsucker are as follows:

- minimum patch size of 16 ha
- suitable nest trees (at least 5.6/territory or 0.35/ha):
  - contain nest cavities with entrances in the size range made and used by sapsuckers (3 to 5 cm diameter)
  - either alive with internal decay and/or stem damage, or dead
  - conifers at least 27 cm DBH (although larger preferred; mean DBH of coniferous nest trees is 72.4 cm):
    - primary species is western larch
    - secondary species include ponderosa pine, Douglas-fir and hybrid white spruce (*Picea glauca* x *engelmannii*)
  - deciduous trees at least 22 cm DBH (although larger preferred)
    - primary species is trembling aspen (particularly in clumps < 1 ha)
    - secondary species include water birch and black cottonwood
- live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)
- colonies of aphid-tending ants for foraging

3.3.2.3 American Badger and Reptile Habitat Features Searches

The survey method for American badger followed the den survey protocol outlined in the Inventory Methods for Medium-sized Territorial Carnivores: Coyote, Red Fox, Lynx, Bobcat, Wolverine, Fisher & Badger (BC MELP 1999a). Maps with imagery to indicate grassland and open forest habitats within 500 m of the Reroute centreline to align with the 500 m protective buffer for American badger maternity dens were used in the field to select the areas to be surveyed. Areas were searched along transects, with spacing between transects determined in the field considering terrain and visibility.

Any potential badger dens discovered were inspected to determine if they are occupied. Examples of options for determining if a den is occupied include:

- Inspecting the den for evidence of recent use (*e.g.*, badger hairs on roots/vegetation or fresh tracks at the den entrance, freshly upturned soil, recent claw marks on the side of the den entrance) and looking into the den as far as possible.

- Placing sticks across the entrance and revisiting the next day (if the sticks have been moved it may indicate that the den is being used).

All dens with evidence of badger use were recorded, including the date of the observation, the evidence observed, a GPS location, description of the habitat and photos.

In conjunction with the badger den searches, a search for potentially suitable snake habitat was completed, with focus on habitat features that may provide:

- over-wintering habitat – including, south-facing rock outcrops and talus slopes, or south-facing areas of deep sandy, loamy or gravelly soils appropriate for digging earthen burrows; and
- gestational and egg-laying habitat – including south-facing slopes or banks with loose, sandy substrate; rodent burrows; talus slopes; rock fissures; or decaying wood.

Habitat features that potentially support reptile use were recorded, including the date of the observation, any evidence of use by a reptile or lack of evidence of use, a GPS location, description of the habitat and photos.

GPS tracks were recorded to document the areas surveyed. The start and end point of transects were documented. If there is an obvious change in habitat or land use, the crew stopped the transect and started a new transect.

Observations of badgers or reptiles were recorded, including the number of individuals, life stage (*e.g.,* adult, juvenile), species (in the case of reptiles), GPS location, and other relevant information that could inform the habitat use (*e.g.,* foraging, basking, denning). Additional information recorded for each transect included the date, the start and end times, weather conditions, and a description of the habitat and any site-specific features.

3.3.2.4 Common Nighthawk and Short-eared Owl Surveys

Call playback surveys for common nighthawk were paired with point count surveys for short-eared owl. Common nighthawk and short-eared owl survey methods followed the Inventory Methods for Nighthawk and Poorwill (BC MELP 1998b) and the Inventory Methods for Raptors (BC MSRM 2001), except for repeat visits.

Survey sites for common nighthawk and short-eared owl surveys were selected in potentially suitable habitats along the Reroute, including open forests, grasslands and pastures, based on a review of aerial imagery and the professional knowledge of the biologists in the field.

Surveys for these crepuscular species were conducted at a total of 18 sites (Figure 3) and completed between sunset until the end of the dusk crepuscular period (*i.e.,* nautical twilight) (approximately 9:12 PM to 11:00 PM). Surveys were conducted during suitable weather conditions (wind <20 km/hr, temperature close to seasonal average, minimal precipitation and limited noise). Surveys began with a three-minute passive listening period for both species upon arrival at the survey site, followed by a 3-minute call playback for common nighthawk.

One call playback was conducted per site, using the following sequence:

1. Broadcast common nighthawk vocalizations for 30 seconds followed by 30 seconds of silence, turning the caller 120° between each broadcast.
2. Repeat call sequence three times if no response is detected.
3. Stop the call sequence if a response is elicited.
4. 2-minute quiet observation period following the last broadcast before moving to the next station.

The approximate distance and direction to all common nighthawk and short-eared owl detections during the survey period were recorded. Additional information recorded at each survey location included the date, start and end time, weather conditions, GPS location and description of the habitat and any site-specific features.

3.3.2.5 Owl Call Playback Surveys

Call playback surveys were conducted in forested habitats along the Reroute to collect information on the presence of flammulated owl and western screech-owl. Surveys followed protocols outlined in the Inventory Methods for Owls (Hausleitner 2006).

Survey sites were selected in potentially suitable habitats along the Reroute, including open coniferous forests for flammulated owl and mixedwood forests near the Coldwater River crossings for western screech-owl, based on a review of aerial imagery and the professional knowledge of the biologists in the field.

Call playback surveys were conducted at a total of 20 sites (Figure 3) and completed following the crepuscular bird surveys, starting no earlier than approximately 30 minutes after sunset to 30 minutes before sunrise. One call playback was conducted per site, using the following sequence:

1. 1-minute quiet period upon arrival to each survey site to listen for the target species and to allow for disturbances in accessing the site to subside.
2. If the target species is not heard during the quiet period, broadcast calls for one minute, turning the caller 360° during the broadcast, followed by a 4-minute passive listening period.
3. Repeat call sequence three times if no response is detected, for a total of 15 minutes.
4. Stop the call sequence if a response is elicited and record the distance and direction to the response.

All observations of owls (visual and/or auditory) were identified to species, where possible, and recorded. Additional information recorded at each site included the date, start and end time, weather conditions and description of the habitat and any site-specific features.

3.3.2.6 Spotted Bat Habitat Reconnaissance

A cliff feature along the Coldwater River located south of AK 1.25 was visited to assess the suitability of the habitat for spotted bats (Figure 3). If suitable habitat for spotted bat was identified, a point count survey for spotted bat was to be conducted following the protocols outlined in the Inventory Method for Bats (BC MELP 1998a); however, no suitable habitat was found, and the point count methods are therefore not detailed herein.

3.4 Limitations of the Surveys

Wildlife surveys completed are based on presence, not detected survey protocols; therefore, a lack of detections does not confirm absence from the area. Most sites were surveyed once (*i.e.,* repeat visits were not conducted), which can reduce the probability of detection of target species/groups given site conditions (*e.g.,* temperature, precipitation, wind) can vary over the survey window and affect species detectability. Additionally, the availability of suitable breeding habitat for amphibians can vary year-to-year due to seasonal and weather conditions. Although several wetlands on and adjacent to the Reroute were dry at the time of the wildlife surveys, these wetlands may be suitable for amphibians in subsequent years with greater snowpack or precipitation. The wildlife surveys completed for the Reroute are adequate to inform the assessment of potential adverse effects on wildlife and wildlife habitat. The limitations outlined above will be addressed by pre-construction surveys that will be conducted prior to clearing/construction activities, if Project activities overlap with sensitive periods for wildlife, to determine the requirements for additional site-specific mitigation, where warranted.

While the owl call playback survey timing was suitable for flammulated owl, it was completed outside the optimal timing window for western screech-owl, which limits the survey detection confidence. Trans Mountain will complete supplemental call playback surveys for western screech-owl in suitable habitat along the Reroute in early spring 2021, during the appropriate survey timing window, and site-specific mitigation will be implemented in the event an active nest is identified. Updated information will also be collected as necessary to fulfill commitments related to CER Condition 44 (*e.g.,* identification of locations of site-specific biophysical attributes within the final footprint, such as suitable nest trees for Williamson's sapsucker, for mitigation implementation).

4.0 RESULTS

This section summarizes the results of the desktop review and field data collection.

4.1 Results of Desktop Review

4.1.1 Identified Wildlife Areas

The Reroute centreline interacts with critical habitat for Williamson's sapsucker as mapped by ECCC for a total length of 11.04 km (ECCC 2019) (Table 3 and Figure 4). Approximately 90% of the Reroute centreline within Williamson's sapsucker critical habitat is parallel to existing linear features, which allows shared workspace to reduce the overall pipeline construction footprint. The Reroute Footprint was used to estimate the area of potential Reroute disturbance within critical habitat, and to calculate overlap with critical habitat (Table 3).

Roads planned for the Reroute interact with critical habitat for Williamson's sapsucker for a total length of approximately 9.13 km and total area of 17.53 ha.

The Wildlife LSA overlaps Lewis's woodpecker critical habitat, but it is located 394 m north of the Reroute corridor (near AK 0) and is not expected to interact with the Reroute. Early Draft critical habitat mapping for western screech-owl, macfarlanei ssp. is not currently available along the Reroute. As part of ongoing consultation with ECCC, Trans Mountain has requested available critical habitat mapping or updates for the Project, including the Reroute.

TABLE 3

SUMMARY OF REROUTE INTERACTION WITH CRITICAL HABITAT FOR WILLIAMSON'S SAPSUCKER

AK Range[1]	Length within Critical Habitat (km)[1]	Area within Critical Habitat (ha)[2]
AK 3.06 to AK 3.16	0.10	0.96
AK 3.33 to AK 3.48AK 3.51 to AK 5.40	2.05	15.88
AK 5.52 to AK 7.32	1.80	11.56
--	--	0.01[3]
AK 7.65 to AK 7.80	0.15	1.02
--	--	0.01[3]
--	--	0.04[3]
AK 8.04 to AK 8.56	0.52	2.66
AK 8.59 to AK 10.20	1.60	9.09
AK 10.61 to AK 10.68 AK 10.69 to AK 11.38	0.77	6.21
AK 11.85 to AK 15.48AK 15.86 to AK 15.96AK 15.98 to AK 16.29	4.05	26.49
--	--	1.02[3]
--	--	0.08[3]
--	--	0.16[3]
--	--	0.04[3]
TOTAL	11.04	75.22

Source: ECCC 2019

Notes:
1 Measured based on the Reroute centreline.
2 Measured based on the Reroute Footprint.
3 Does not cross the Reroute centreline, however, crosses the Reroute Footprint, therefore included for area calculations.

The Reroute centreline interacts with Provincially identified wildlife areas, including WHAs for Williamson's sapsucker and an approved UWR for mule deer (U-3-003) (BC MFLNRORD 2019c, 2019e) (Figure 4). The lengths and areas of the Reroute within each segment of the WHAs and UWR crossed by the Reroute are provided in Tables 4 and 5, respectively.

The Reroute Footprint was used to calculate the area of WHAs and UWR interaction with the Reroute. Approximately 88% of the length within the WHAs for Williamson's sapsucker (Table 4) overlaps with areas of critical habitat for Williamson's sapsucker (Table 3). Based on the Reroute Footprint, construction of the Reroute will affect approximately 3% of the area of WHA 3-131, 6% of WHA 3-132, 13% of WHA 3-134, 0.3% of WHA 3-211, 13% of WHA 3-212 and 10% of WHA 3-214, and <0.1% of the area of UWR U-3-003. Based on the Reroute Footprint, construction of the Reroute will affect approximately 0.2% of the area of Williamson's sapsucker critical habitat identified in the Western Area of Occupancy (ECCC 2016). The entire length of the Reroute centreline within the WHAs for Williamson's sapsucker is parallel to existing linear features, which allows shared workspace to reduce the overall pipeline construction footprint. Approximately 85% of the Reroute centreline within UWR is parallel to existing linear features.

Roads planned for the Reroute interact with WHAs (3-132, 3-134, 3-212 and 3-215) for Williamson's sapsucker for a total length of approximately 2.98 km and total area of 5.76 ha. In addition, roads planned for the Reroute interact with UWR U-3-003 for a total length of approximately 15.79 km and total area of 26.95 ha.

TABLE 4

SUMMARY OF REROUTE INTERACTION WITH WILDLIFE HABITAT AREAS FOR WILLIAMSON'S SAPSUCKER

WHA	AK Range[1]	Length within WHA (km)[1]	Area within WHA (ha)[2]
3-131	AK 5.00 to AK 5.13	0.13	1.02
3-211	--	--	0.01[3]
3-211	--	--	0.13[3]
3-212	AK 6.89 to AK 7.76	0.87	5.45
3-214	--	--	0.08[3]
3-214	AK 8.02 to AK 8.83	0.81	4.41
3-132	AK 9.21 to AK 9.30	0.10	0.59
3-132	AK 9.56 to AK 9.98	0.40	2.21
3-134	AK 12.34 to AK 13.25	0.91	5.40
3-134	--	--	1.02[3]
	TOTAL	3.22	20.33

Source: BC MFLNRORD 2019c

Notes:
1 Measured based on the Reroute centreline.
2 Measured based on the Reroute Footprint.
3 Does not cross the Reroute centreline, however, crosses the Reroute Footprint, therefore included for area calculations.

TABLE 5

SUMMARY OF REROUTE INTERACTION WITH UNGULATE WINTER RANGE FOR MULE DEER (U-3-003)

AK Range[1]	Length within UWR (km)[1]	Area within UWR (ha)[2]
AK 0 to AK 0.48	0.48	4.12
AK 2.64 to AK 15.01	12.37	88.16
AK 15.45 to AK 16.77	1.32	9.89
TOTAL	14.17	102.18

Source: BC MFLNRORD 2019b

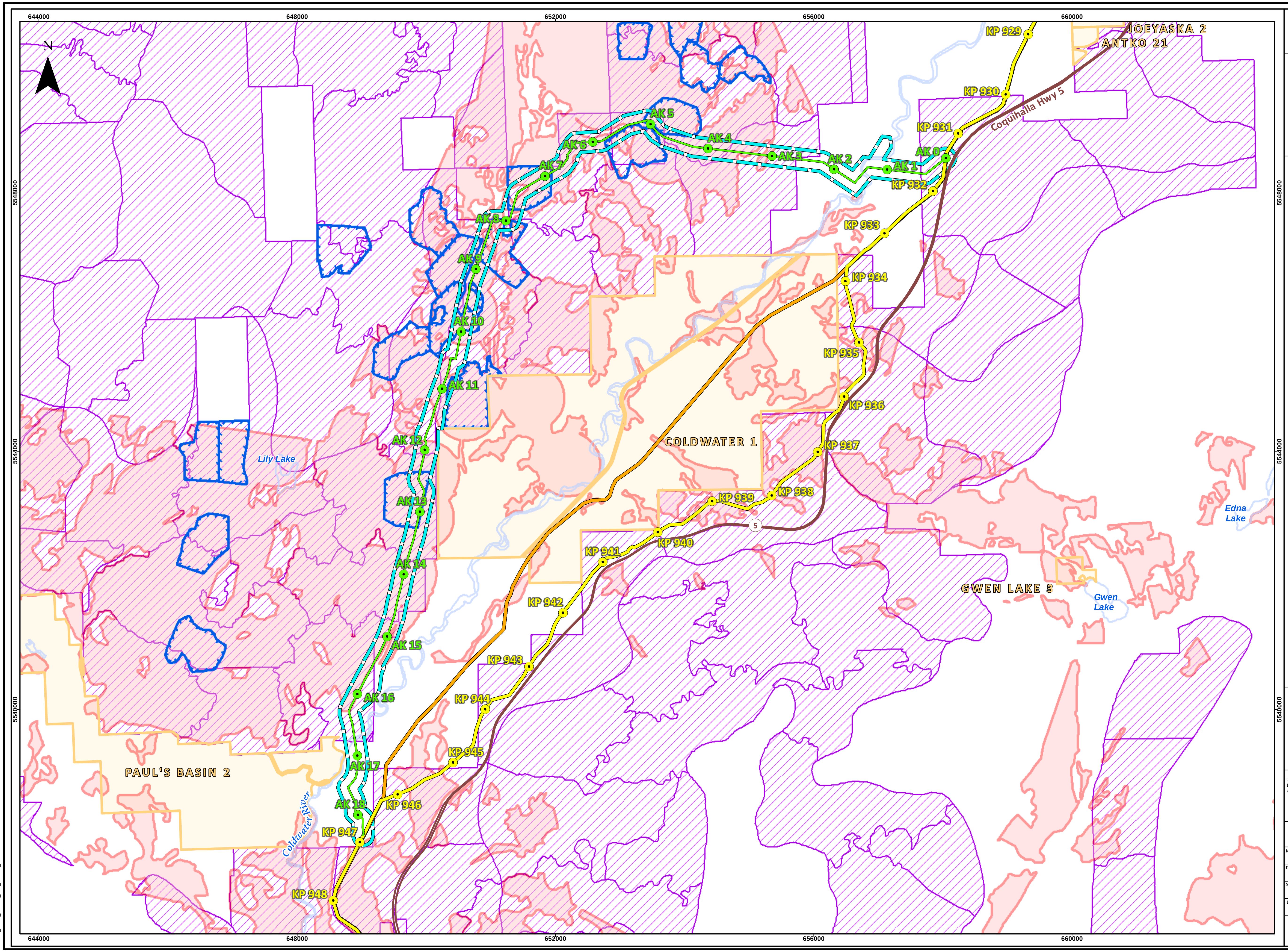
Notes:
1 Measured based on the Reroute centreline.
2 Measured based on the Reroute Footprint.

The Wildlife LSA does not cross any other identified wildlife areas (*e.g.,* caribou range or caribou Local Population Units [BC MOE 2010; Environment Canada 2014], proposed UWR [BC MFLNRORD 2019d], or proposed WHAs [BC MFLNRORD 2020b]). The Wildlife LSA is located entirely within an Extirpated Grizzly Bear Population Unit (BC MFLNRORD 2020a).

The Wildlife LSA is not located within any parks or protected areas (BC Parks 2020), National Wildlife Areas (Government of Canada 2020), Migratory Bird Sanctuaries (Government of Canada 2019a), Important Bird Areas (Bird Studies Canada 2015), Western Hemisphere Shorebird Reserves (WHSRN 2019) or Ramsar wetlands (The Secretariat of the Convention on Wetlands 2020).

4.1.2 Provincial Database

A search of the BC CDC database identified occurrence polygons for two species at risk within 1 km of the Reroute corridor. An occurrence polygon from 2007 for western screech-owl, *macfarlanei* subspecies (ssp.) (Threatened on Schedule 1 of *SARA* and by COSEWIC) is crossed by the Reroute near the Coldwater River (BC MFLNRORD 2019a,b). Occurrence polygons from observations between 1984 and 2012 for Williamson's sapsucker (Endangered on Schedule 1 of *SARA* and by COSEWIC) are crossed by the Reroute at seven locations (BC MFLNRORD 2019a,b).



TRANS MOUNTAIN

FIGURE 4

IDENTIFIED WILDLIFE AREAS

PROPOSED TRANS MOUNTAIN PIPELINE ULC

COLDWATER WEST ALTERNATIVE REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● TMEP Pipeline Kilometre Post (KP)
- — Coldwater Reroute
- — TMEP Pipeline
- — Existing TMPL Pipeline
- —①— Highway
- ▭ Coldwater Reroute 300m Corridor
- 🟥 Critical Habitat Williamson's Sapsucker
- ▨ Wildlife Habitat Area
- ▨ Ungulate Winter Range (U-3-003)
- ▭ Indian Reserve
- ▭ Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI; September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Coldwater Corridor, Jacobs September 08, 2020; Transportation: BC MFLNRO 2015; Hydrology: BC MFLNRO 2014; Critical Habitat: ECCC 2019; BC Wildlife Habitat Areas and Ungulate Winter Ranges: BC MFLNRO 2020; First Nation Lands: Government of Canada 2019.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202001_MAP_CH2M_WL_01165_REV3

DATE	REFERENCE	REVISION
September 2020	CE771600	3
SCALE	**PAGE SIZE**	**DISCIPLINE**
1:55,000	11x17	WL
DRAWN	**CHECKED**	**DESIGN**
SAB	DJN	CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202001_MAP_CH2M_WL_01165_Rev3.mxd

4.1.3 Species at Risk and Species of Special Conservation Status

Using the methods described in subsection 3.2.1, a comprehensive list of both the wildlife species at risk (*i.e.,* species listed federally on Schedule 1 of the *SARA* or by the COSEWIC) and the wildlife species of special conservation status (*i.e.*, species that only have provincial conservation designations) that have the potential to interact with the Reroute is provided in Appendix A. A list of the species at risk that have the potential to interact with the Reroute is also provided as follows.

- American badger, *jeffersonii* ssp (*Taxidea taxus jeffersonii*), Endangered on Schedule 1 of *SARA* and by COSEWIC
- little brown myotis (*Myotis lucifugus*), Endangered on Schedule 1 of *SARA* and by COSEWIC
- bank swallow (*Riparia riparia*), Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC
- barn swallow (*Hirundo rustica*), Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC
- bobolink (*Dolichonyx oryzivorus*), Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC
- common nighthawk (*Chordeiles minor*), Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC
- evening grosbeak (*Coccothraustes vespertinus*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- flammulated owl (*Psiloscops flammeolus*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- horned grebe (*Podiceps auratus*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- long-billed curlew (*Numenius americanus*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- olive-sided flycatcher (*Contopus cooperi*), Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC
- rusty blackbird (*Euphagus carolinus*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- short-eared owl (*Asio flammeus*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- western screech-owl, *macfarlanei* ssp. (*Megascops kennicottii macfarlanei*), Threatened on Schedule 1 of *SARA* and by COSEWIC
- Williamson’s sapsucker (*Sphyrapicus thyroideus*), Endangered on Schedule 1 of *SARA* and by COSEWIC
- Great Basin gophersnake (*Pituophis catenifer deserticola*), Threatened on Schedule 1 of *SARA* and by COSEWIC
- rubber boa (*Charina bottae*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- western yellow-bellied racer (*Coluber constrictor mormon*), Special Concern on Schedule 1 of *SARA* and Threatened by COSEWIC
- western toad (*Anaxyrus boreas*), Special Concern on Schedule 1 of *SARA* and by COSEWIC
- monarch (*Danaus plexippus*), Special Concern on Schedule 1 of *SARA* and Threatened by COSEWIC

Spotted bat, Lewis's woodpecker and Great Basin spadefoot were considered for species with potential to interact with the Reroute. However, given the Reroute does not interact with identified critical habitat for these species, there are no recorded occurrences within 1 km of the route, and the habitat suitability along the Reroute for these species was determined to be low during the spring 2020 wildlife surveys, these species were scoped out of having potential to interact with the Reroute.

4.2 Results of Field Data Collection

The results of the wildlife field data collection conducted for the Reroute are summarized in the following subsections. A comprehensive list of species observed during the spring 2020 wildlife surveys is provided in Appendix B. Select photoplates from the spring 2020 wildlife surveys are provided in Appendix C.

4.2.1 General Habitat Description

Wildlife habitat along the Reroute is generally characterized by forest dominated by Douglas-fir and ponderosa pine stands (Plate C-1) with areas of tame pasture (Plate C-2). Terrain along the Project is generally gently to moderately rolling, with moderate to steep slopes encountered at the Coldwater River crossings. Land cover crossed by the Reroute centreline includes: wetland (58 m), riparian (1,086 m), river (91 m), shrubs (1,215 m), forest (13,680 m), hay (712 m), tame pasture (1,861 m), and disturbances including roads and existing rights-of-way (28 m). Hay vegetation/land cover is cleared annually, whereas tame pasture vegetation/land cover represent areas where cattle grazing occurs and are not cleared annually. Logged areas that have re-generated to tall shrubs are included with shrubs. There are no native grasslands on the Reroute.

The Reroute crosses 2 fish-bearing watercourses (Coldwater River, crossed twice, and Salem Creek), and 32 nonfish-bearing drainages (including 6 non-classified drainages and 25 classified as no visible channel).

A total of four wetlands and ten flood associations are encountered by the Reroute Footprint. A total of ten wetlands and ten flood associations are encountered by the Reroute corridor. There are four wetlands and two flood associations encountered by the access road footprints. The wetland classes include emergent marsh, deep emergent marsh, seasonal emergent marsh, seasonal marsh, open water pond, shrubby swamp and wet meadow.

4.2.2 Amphibian Surveys

The locations of the amphibian survey sites are shown on Figure 2. Amphibian species observed during the amphibian surveys included Columbia spotted frog, long-toed salamander, northern pacific treefrog and western toad (Special Concern on Schedule 1 of *SARA* and by COSEWIC).

As mentioned in subsection 3.3.2.1, the amphibian surveys focused on potentially suitable Great Basin spadefoot habitat. However, the habitat suitability for Great Basin spadefoot along the Reroute was determined to be low due to the presence of soils with low suitability for digging/burrowing (*i.e.*, soils in the general area consist largely of silt loam to silty loam clays compared to more friable soils such as sandy clay loam and fine gravels) and areas of densely vegetated and forested terrestrial habitat. Therefore, Great Basin spadefoot are not expected to occur near the Reroute.

Amphibians were detected at eight of the nine amphibian survey sites and incidentally observed at two additional locations. A summary of the amphibian survey sites and incidental locations where amphibians were observed are presented in Table 6. Evidence of amphibian breeding (*i.e.,* tadpoles) was observed at four survey sites (Table 6). Western toad was the only amphibian species at risk observed, and it was observed at two sites.

TABLE 6

SUMMARY OF AMPHIBIAN OBSERVATIONS

Site ID	Nearest AK	UTM (NAD 83)	Associated Wetland/ Watercourse ID	Approximate Distance and Direction from Pipeline Centreline	Species Observed
AMP-01[1]	AK 2.59 to AK 2.62	10U 655773E 5548746N	CW_WT-023	171 m north	Time-Constrained Search • Long-toed salamander (1 tadpole) • Northern pacific treefrog (>100 tadpoles) Auditory Survey • None
AMP-05	AK 3.35 to AK 3.37	10U 655010E 5548638N	CW_WT-001	18 m north	• Northern pacific treefrog (approximately 50 tadpoles)
AMP-08	AK 3.49 to AK 3.51	10U 654843E 5548603N	CW_WT-002	26 m south	• Columbia spotted frog (1 adult)
N/A[2]	AK 4.36	10U 653988E 5548707N	N/A[3]	53 m south	• Northern pacific treefrog (unknown number)
AMP-13	AK 8.60 to AK 8.70	10U 650722E 5547245N	CW_WT-009	163 m west	• Columbia spotted frog (1 adult)
AMP-21	AK 8.86 to AK 8.90	10U 650858E 5546925N	CW_WT-011	36 m east	• Columbia spotted frog (1 adult) • Western toad (1 juvenile)
N/A[2]	AK 9.11	10U 650699E 5546725N	CWIRW-19 (observed within a small low-lying area = no visible channel)	29 m west	• Columbia spotted frog (unknown number)
AMP-15[1]	AK 9.04 to AK 9.12	10U 650608E 5546605N	CW_WT-013	60 m west	Time-Constrained Search • Columbia spotted frog (19 adults) • Northern pacific treefrog (1 tadpole and 3 adults) Auditory Survey • Northern pacific treefrog (Call code 2)
AMP-16	AK 10.13 to AK 10.26	10U 650372E 5545730N	CW_WT-014	119 m west	• Columbia spotted frog (1 adult)
AMP-18	AK 13.39 to AK 13.46	10U 649782E 5542660N	CW_WT-016	Crossed by the centreline	• Long-toed salamander (25 tadpoles) • Western toad (1 adult)

Notes: 1 Time-constrained search and auditory survey competed.
2 Incidental observation.
3 Observed within terrestrial habitat.

4.2.3 Williamson's Sapsucker Call Playback Surveys

The locations of the Williamson's sapsucker call playback survey sites are shown on Figure 2. Williamson's sapsuckers were detected at 16 of the 32 Williamson's sapsucker call playback survey sites and incidentally observed at two additional locations. A summary of the call playback survey sites and incidental locations where Williamson's sapsucker were observed are presented in Table 7.

TABLE 7

SUMMARY OF WILLIAMSON'S SAPSUCKER OBSERVATIONS

Site ID	Nearest AK	UTM (NAD 83)	Comments
WISA 1	AK 3.02	10U 655333E 5548549N	One individual observed (auditory)
WISA 2	AK 3.58	10U 654783E 5548660N	One individual observed (auditory)
WISA 3	AK 3.98	10U 654384E 5548695N	One individual observed (auditory)
WISA 4	AK 4.43	10U 653888E 5548619N	One individual observed (auditory)
WISA 5	AK 4.74	10U 653663E 5548899N	One male observed (visual)
N/A[1]	AK 4.93	10U 653562E 5549053N	One male was observed foraging or excavating a cavity north of the centreline
WISA 6	AK 5.13	10U 653367E 5549103N	One individual observed (auditory)
N/A[1]	AK 5.95	10U 652629E 5548823N	A pair was observed foraging at a large ant colony
WISA 7	AK 5.60	10U 652947E 5548928N	One male observed (visual)
WISA 8	AK 5.99	10U 652592E 5548781N	One individual observed (auditory)
WISA 12	AK 7.74	10U 651323E 5547780N	One individual observed (auditory)
WISA 15	AK 9.13	10U 650722E 5546695N	One individual observed (auditory)
WISA 16	AK 9.63	10U 650601E 5546215N	One individual observed (auditory)
WISA 18	AK 10.62	10U 650331E 5545341N	One individual observed (auditory)
WISA 21	AK 11.88	10U 650033E 5544140N	One individual observed (auditory)
WISA 23	AK 12.70	10U 649988E 5543348N	One individual observed (auditory)
WISA 26	AK 13.94	10U 649704E 5542141N	Two males observed (visual)
WISA 27	AK 14.26	10U 649585E 5541838N	Two males observed (visual)

Note: 1 Incidental observation

4.2.4 *Williamson's Sapsucker Field Review of Biophysical Attributes of Critical Habitat*

The biophysical attributes of critical habitat for Williamson's sapsucker were reviewed along the entire length of the Reroute Footprint that interacts with critical habitat for Williamson's sapsucker and WHAs for Williamson's sapsucker.

Table 8 provides a summary of the biophysical attribute review.

TABLE 8

BIOPHYSICAL ATTRIBUTES OF CRITICAL HABITAT FOR WILLIAMSON'S SAPSUCKER

Critical Habitat AK Range	WHA AK Range	Biophysical Attribute[1]	Present ✓ or ✗	Comments
AK 2.3.06 to AK 3.16 (0.1 km)	N/A	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest tree was observed in area located approximately 20 m outside critical habitat.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed throughout area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.
AK 3.33 to AK 3.48; and AK 3.51 to AK 5.40 (2.05 km)	AK 4.99 to AK 5.13 (0.13 km)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.

TABLE 8 Cont'd

Critical Habitat AK Range	WHA AK Range	Biophysical Attribute[1]	Present ✓ or ✘	Comments
AK 5.52 to AK 7.32 (1.80 km)	AK 6.89 to AK 7.32 (0.43)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.
N/A	AK 7.32 to AK 7.65 (0.34)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest tree was observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed throughout area.
		Colonies of aphid-tending ants for foraging	✘	No evidence of ant colonies observed in area.
AK 7.65 to AK 7.80 (0.15 km)	AK 7.65 to AK 7.76 (0.11)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✘	No evidence of ant colonies observed in area.
N/A	AK 8.02 to AK 8.04 (0.02 km) Note, area of overlap with WHA is minor	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✘	No suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✘	No live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✘	No evidence of ant colonies observed in area.
AK 8.04 to AK 8.56 (0.52 km)	AK 8.04 to AK 8.56 (0.52 km)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.
N/A	AK 8.56 to AK 8.59 (0.03 km) Note, area of overlap with WHA is minor	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✘	No suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✘	No evidence of ant colonies observed in area.
AK 8.59 to AK 10.20 (1.60 km)	AK 8.59 to AK 8.83 (0.24 km) AK 9.21 to AK 9.30 (0.10 km) AK 9.56 to AK 9.98 (0.40)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.
AK 10.61 to AK 10.68 and AK 10.69 to AK 11.38 (0.77 km)	N/A	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area.
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.
AK 11.85 to AK 15.48; AK 15.86 to AK 15.96; and AK 15.98 to AK 16.29 (4.05 km)	AK 12.34 to AK 13.25 (0.91)	Suitable nest trees (at least 5.6/territory or 0.35/ha)	✓	Suitable nest trees were observed in area (Plate C-3).
		Live trees for foraging and cover (at least 85/ha in the >17.5 cm DBH class)	✓	Live trees of suitable size observed in area.
		Colonies of aphid-tending ants for foraging	✓	Evidence of ant colonies observed in area.

Note: 1 Based on the biophysical attributes described in the *Amended Recovery Strategy for the Williamson's Sapsucker (Sphyrapicus thyroideus) in Canada* (ECCC 2016). The biophysical attribute of minimum patch size of 16 ha was assumed to be accounted for by ECCC when delineating each polygon of critical habitat and was not reviewed in the field.

4.2.5 American Badger and Reptile Habitat Feature Searches

Habitat feature searches for American badger and reptiles were completed on the Reroute Footprint and adjacent areas (up to 500 m from the centreline) from approximately 200 m north of AK 1.51 to AK 2.20 (0.56 km along the previous HDD centreline), from approximately AK 2.20 to AK 5.19 (2.99 km) and from approximately AK 7.39 to AK 10.76 (3.37 km).

No American badgers or potential dens were observed during the habitat feature searches or incidentally during the field data collection.

Eight garter snakes (unidentified species) and one skin shed were observed approximately 41 m west of the centreline near AK 9.30, indicating that a hibernaculum (*i.e.*, over-wintering den) may be in the vicinity, though no obvious hibernacula habitat/features were noted in the area. Suitable hibernacula habitat for snakes was observed along a rocky slope located approximately 42 m south of the centreline near AK 2.30 (Plate C-4), however, there was no evidence of use or snake observations in this area. No additional habitat suitable for hibernacula (*i.e.,* over-wintering habitat) or any suitable habitat for gestation/egg-laying was recorded during the field data collection.

In addition to the above, three northern alligator lizards and one terrestrial garter snake were observed during the habitat transects, though they were not associated with any potential/suspected hibernacula sites. Common garter snakes (unknown number) and garter snakes (unknown number of unidentified species) were observed incidentally during the field data collection.

4.2.6 Common Nighthawk and Short-eared Owl Surveys

The locations of the common nighthawk/short-eared owl survey sites are shown on Figure 3. Common nighthawks were detected at 11 survey sites and incidentally at nine additional locations (Table 9). Short-eared owls were not observed during the point count surveys or incidentally during the field data collection.

TABLE 9

SUMMARY OF COMMON NIGHTHAWK OBSERVATIONS

Site ID	Nearest AK	UTM (NAD 83)	Comments
CONI 1	AK 1.93	10U 656424E 5548401N	Two individuals detected. Four individuals detected while walking to site.
FLOW 3[1]	AK 2.63	10U 655742E 5548733N	One individual incidentally detected.
N/A[1]	AK 2.94	10U 655410E 5548539N	One individual incidentally detected.
CONI 3	AK 3.48	10U 654883E 5548661N	One individual detected.
CONI 4	AK 3.73	10U 654627E 5548652N	One individual detected.
N/A[1]	AK 3.95	10U 654403E 5548652N	Two individuals incidentally detected.
N/A[1]	AK 3.98	10U 654342E 5548341N	One individual incidentally detected.
CONI 6	AK 4.57	10U 653800E 5548795N	One individual detected.
N/A[1]	AK 5.07	10U 653445E 5549163N	One individual incidentally detected.
CONI 7[1]	AK 7.43	10U 651460E 5548044N	One individual incidentally detected.
CONI 8	AK 7.91	10U 651298E 5547609N	One individual detected.
CONI 9	AK 8.39	10U 650936E 5547404N	One individual detected.
N/A[1]	AK 9.27	10U 650510E 5546618N	One individual incidentally detected.
CONI 12	AK 9.60	10U 650544E 5546259N	One individual detected.
CONI 14	AK 10.40	10U 650442E 5545460N	One individual detected.
N/A[1]	AK 14.15	10U 649616E 5541946N	One individual incidentally detected.
CONI 15	AK 16.85	10U 649038E 5539449N	Fifteen individuals detected.
FLOW 17[1]	AK 17.68	10U 648847E 5538655E	One individual incidentally detected.
CONI 17	AK 17.73	10U 648947E 5538649N	One individual detected.
CONI 18	AK 18.13	10U 649022E 5538270N	Two individuals detected.

Note: 1 Incidental observation

4.2.7 Owl Call Playback Surveys

The locations of the flammulated owls or western screech-owl call playback survey sites are shown on Figure 3. No flammulated owls or western screech-owl were detected during the owl call playback surveys or incidentally during the field data collection.

4.2.8 Spotted Bat Habitat Reconnaissance

The potential cliff feature along the Coldwater River located south of AK 1.25 was determined to be unsuitable habitat for spotted bats. No spotted bats or suitable habitat were incidentally recorded during the field data collection.

4.2.9 Incidental Species

All incidental wildlife observations of target species (*i.e.*, Williamson's sapsucker and common nighthawk) and target species group (*i.e.,* amphibians and reptiles) that were recorded are included in the respective previous sections. Other incidental species observations are summarized as follows.

Carnivores or their signs observed included American black bear, coyote, and striped skunk: bear scat was observed south of AK 6.83; coyote were heard calling near AK 3.58; and striped skunk were observed north of AK 3.32 and near AK 3.45. Red squirrels were commonly heard calling during the wildlife surveys and least chipmunk were observed in coniferous dominated forest near AK 15.92 and AK 16.32. Unidentified bat species were observed flying overhead in open habitat near AK 4.57 and AK 9.60.

In addition to Williamson's sapsucker and common nighthawk, a total of 51 bird species were observed (auditory or visual observations) during the wildlife surveys conducted for the Reroute (Appendix B), including one species at risk: olive-sided flycatcher (listed as Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC). Olive-sided flycatcher were heard calling near AK 6.68 and AK 8.34. Two Provincially Red- and Blue-listed species were also incidentally observed: northern goshawk (Blue-listed) was observed near AK 11.98 and Swainson's hawk (Red-listed) was observed near AK 7.43. The most commonly observed bird species included American robin, dusky flycatcher, red-breasted nuthatch, ruby-crowned kinglet and Swainson's thrush.

Evidence of pileated woodpecker foraging activity (foraging cavities) was identified near AK 5.62. An active cavity nest occupied by a hairy woodpecker was incidentally observed approximately 41 m south of the centreline near AK 5.63. An active white-breasted nuthatch nest was identified in a crack of a standing dead tree (snag) approximately 18 m north of AK 3.04. Several old owl pellets and bones were observed around the base of the tree, indicating that the snag may have been previously used for nesting by an unknown owl species.

Five potential mammal dens (unknown species) were observed (Table 10). No sign or evidence of recent use was observed at the dens.

TABLE 10

POTENTIAL MAMMAL DEN OBSERVATIONS

Nearest AK	UTM (NAD 83)	Description and Approximate Distance and Direction from the Centreline
AK 2.48	10U 655865E 5548488N	23 m south
AK 3.49	10U 654875E 5548718N	Small mammal (*e.g.*, rodent) den under boulder 89 m north
AK 3.78	10U 654601E 5548843N	Den under large downed tree 181 m north
AK 5.59	10U 652942E 5548955N	Den under coarse woody debris 9 m northwest (Plate C-5)
AK 6.93	10U 651922E 5548252N	Potential den within large decayed log 51 m southeast

No additional wildlife habitat features (*e.g.,* stick nests, dens, mineral licks, or roosts) were identified during the field data collection.

5.0 SUMMARY AND CONCLUSIONS

The wildlife desktop review and field data collection provided the opportunity to review habitat suitability for wildlife, including species at risk, and to identify wildlife habitat features within and adjacent to the Reroute corridor. Wildlife habitat features identified during the field data collection that may be affected by the Reroute have been added to the Reroute-specific Environmental Resource Maps. If the Variance Application is approved, Environmental Alignment Sheets and Resource-Specific Mitigation Tables will be provided to the CER prior to construction. A summary of key findings identified during the field data collection is provided in Table 11.

TABLE 11

WILDLIFE FIELD DATA COLLECTION RESULTS SUMMARY

Survey Type	Summary of Results
Amphibian surveys	• Amphibians were observed at eight amphibian survey sites and incidentally at two additional locations. • Evidence of amphibian breeding (*i.e.,* tadpoles) was observed at five amphibian survey sites. • Four amphibian species were identified, including one species at risk (western toad). • No Great Basin spadefoot or suitable breeding habitat for Great Basin spadefoot was observed.
Williamson's sapsucker call playbacks / biophysical attribute review	• Williamson's sapsuckers were detected at 16 Williamson's sapsucker survey sites and incidentally at two additional locations. • Biophysical attributes of Williamson's sapsucker critical habitat were present within critical habitat and WHAs crossed by the Reroute.
American badger/reptile habitat features searches	• No American badgers or potential dens were observed. • Eight garter snakes (unidentified species) and one shed were observed approximately 17 m west of AK 9.30, indicating that a hibernaculum (*i.e.*, over-wintering den) may be in the vicinity, though no obvious hibernacula habitat/features were noted in the area. • Suitable hibernacula habitat for garter snakes was observed along a rocky slope located approximately 38 m south of AK 2.30, however, there was no evidence of use or snake observations in this area. • No additional habitat suitable for hibernacula (*i.e.,* over-wintering habitat) or any suitable habitat for gestation/egg-laying was recorded during the field data collection.
Common nighthawk call playbacks / short-eared owl point counts	• Common nighthawks were observed at 11 survey sites and incidentally at 9 additional locations. • No short-eared owls were observed.
Flammulated owl / western screech-owl call playbacks	• No flammulated owls or western screech-owls were observed.
Spotted bat habitat reconnaissance	• No spotted bats or suitable habitat for spotted bats were observed.
All Surveys	• A total of 5 mammal species, 53 bird species, 4 reptile species and 3 amphibian species and were observed. • Four species at risk were observed, including: common nighthawk (Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC), olive-sided flycatcher (Threatened on Schedule 1 of *SARA* and Special Concern by COSEWIC), Williamson's sapsucker (Endangered on Schedule 1 of *SARA* and by COSEWIC) and western toad (Special Concern on Schedule 1 of *SARA* and by COSEWIC). • A potential old owl nest tree (snag) was identified on the Reroute Footprint near AK 2.8. Evidence of previous owl use was present around the base of the snag (old pellets and bones). The snag contained and active white-breasted nuthatch nest at the time of the field work in June 2020. • Five potential mammal dens (unknown species) were incidentally observed. No sign or evidence of recent use was observed at the dens.

6.0 REFERENCES

6.1 Literature Cited

Banfield, A.W.G. 1974. *The Mammals of Canada*. University of Toronto Press, Toronto, Ontario. 438 pp.

Bird Studies Canada. 2015. *Important Bird Areas of Canada Database.* Port Rowan, Ontario: Bird Studies Canada. Accessed July 2020. http://www.ibacanada.org.

British Columbia Conservation Data Centre (BC CDC). 2020a. *BC Species and Ecosystems Explorer.* Ministry of Environment. Accessed July 2020. http://a100.gov.bc.ca/pub/eswp/.

British Columbia Conservation Data Centre (BC CDC). 2020b. *Red, Blue and Yellow Lists.* Accessed July 2020. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data/red-blue-yellow-lists.

British Columbia Ministry of Environment (BC MOE). 2006. *FIA Activity Standards Document: Information Gathering and Management Component, Resource Inventories Activity Area, Wildlife and Wildlife Habitat Activities, Specifically Williamson's Sapsucker Inventory, Stand-Level Habitat Assessment and Nest Productivity Assessment Standards.* Victoria, BC. 21 pp.

British Columbia Ministry of Environment (BC MOE). 2009. *Conservation Framework: Conservation Priorities for Species and Ecosystems Primer*. Environmental Stewardship Division, Ecosystems Branch. Victoria, BC. 12 pp.

British Columbia Ministry of Environment (BC MOE). 2010. *Caribou Distribution in British Columbia by Ecotype.* Accessed July 2020. http://www.env.gov.bc.ca/wld/speciesconservation/caribou_by_ecotype.html.

British Columbia Ministry of Environment (BC MOE). 2011. *Conservation Framework: Spreadsheet for Species Outputs*. Accessed October 2018. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/setting-priorities/conservation-framework-results.

British Columbia Ministry of Environment, Lands and Parks (BC MELP). 1998a. *Inventory Methods for Bats. Standards for Components of British Columbia's Biodiversity No. 20*. Resources Inventory Committee. Victoria, BC. 58 pp.

British Columbia Ministry of Environment, Lands and Parks (BC MELP). 1998b. *Inventory Methods for Nighthawk and Poorwill.* Standards for Components of British Columbia's Biodiversity No. 9. Resources Inventory Committee. Victoria, BC. 20 pp.

British Columbia Ministry of Environment, Lands and Parks (BC MELP). 1998c. *Inventory Methods for Pond-Breeding Amphibians and Painted Turtle.* Standards for Components of British Columbia's Biodiversity No. 37. Resources Inventory Committee. Victoria, BC. 94 pp.

British Columbia Ministry of Environment, Lands and Parks (BC MELP). 1999a. *Inventory Methods for Medium-sized Territorial Carnivores: Coyote, Red Fox, Lynx, Bobcat, Wolverine, Fisher & Badger.* Standards for Components of British Columbia's Biodiversity No. 25. Version 2.0. Resources Inventory Committee. Victoria, BC. 72 pp.

British Columbia Ministry of Environment, Lands and Parks (BC MELP). 1999b. *Inventory Methods for Woodpeckers. Standards for Components of British Columbia's Biodiversity No. 19*. Version 2.0. Resources Inventory Committee. Victoria, BC. 63 pp.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2019a. *CDC Species, Non - Sensitive* (digital file). Acquired November 25, 2019. https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-publicly-available-occurrences-cdc.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2019b. *CDC Species, Masked Secured* (digital file). Acquired November 25, 2019. https://catalogue.data.gov.bc.ca/dataset/species-and-ecosystems-at-risk-masked-secured-publicly-available-occurrences-cdc.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2019c. *Ungulate Winter Range – Approved* (digital file). Accessed July 2020. https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-approved.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2019d. *Ungulate Winter Range – Proposed* (digital file). Accessed July 2020. https://catalogue.data.gov.bc.ca/dataset/ungulate-winter-range-proposed.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2019e. *Wildlife Habitat Areas – Approved* (digital file). Accessed July 2020. https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-approved.

British Columbia Ministry of Forests, Lands, Natural Resources Operations and Rural Development (BC MFLNRORD). 2020a. *Grizzly Bear Population Units* (digital file). Victoria, British Columbia. Accessed July 2020. https://catalogue.data.gov.bc.ca/dataset/grizzly-bear-population-units.

British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (BC MFLNRORD). 2020b. *Wildlife Habitat Areas – Proposed* (digital file). Accessed July 2020. https://catalogue.data.gov.bc.ca/dataset/wildlife-habitat-areas-proposed.

British Columbia Ministry of Sustainable Resource Management (BC MSRM). 2001. *Inventory Methods for Raptors. Standards for Components of British Columbia's Biodiversity No. 11*. Resources Inventory Committee. Victoria, BC. 133 pp.

British Columbia Oil and Gas Commission (BC OGC). 2018. *Environmental Protection and Management Guideline.* Version 2.7: December 2018. pp. 125.

British Columbia Oil and Gas Commission (BC OGC). 2019. *Oil and Gas Activity Application Manual.* Version 1.33: December 2019. Accessed July 2020. https://www.bcogc.ca/industry-zone/documentation/oil-and-gas-activity-application-manual.

British Columbia Parks (BC Parks). 2020. *BC Parks Map.* Accessed July 2020. http://www.env.gov.bc.ca/bcparks/explore/regions.html.

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. *The Birds of British Columbia*. Volumes 1-4. University of British Columbia Press, Vancouver.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2019. *Canadian Species at Risk.* Accessed July 2020. http://www.cosewic.ca/index.php/en-ca/.

Corkran, C.C. and C. Thoms. 1996. *Amphibians of Oregon, Washington and British Columbia: A Field Identification Guide.* Lone Pine Publishing, Edmonton, Alberta. 175 pp.

Environment Canada. 2014. R*ecovery Strategy for the Woodland Caribou, Southern Mountain population (Rangifer tarandus caribou) in Canada*. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa, ON. viii + 68 pp.

Environment and Climate Change Canada (ECCC). 2016. *Amended Recovery Strategy for the Williamson's Sapsucker (Sphyrapicus thyroideus) in Canada. Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vi + 32 pp.

Environment and Climate Change Canada (ECCC). 2019. C*ritical Habitat for Species at Risk Listed on Schedule 1 of the Federal Species at Risk Act (SARA) in British Columbia* (digital file). Ottawa, On. Acquired February 20, 2019. Updates available at Open Data Portal. http://open.canada.ca/data/en/dataset.

Government of Canada. 2019a. *Migratory Bird Sanctuaries*. Accessed July 2020. https://www.canada.ca/en/environment-climate-change/services/migratory-bird-sanctuaries/locations.html.

Government of Canada. 2019b. *Species at Risk Public Registry*. Accessed July 2020. http://www.sararegistry.gc.ca/.

Government of Canada. 2020. *National Wildlife Areas*. Accessed July 2020. https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/locations.html.

Hausleitner, D. 2006. *Inventory Methods for Owl Surveys. Standards for Components of British Columbia's Biodiversity No. 42*. Revised draft July 2006. Prepared for Ecosystems Branch of the Ministry of Environment for the Resources Information Standards Committee, BC. 52pp.

Matsuda, B.M., D.M. Green, and P.T. Gregory. 2006. *Amphibians and Reptiles of British Columbia.* Royal BC Museum, Victoria, British Columbia.

NatureServe. 2020. *NatureServe Explorer - An Online Encyclopedia of Life*. Accessed July 2020. https://explorer.natureserve.org/.

Stebbins, R.C. 1966. *A Field Guide to Western Reptiles and Amphibians.* The Peterson Field Guide Series. Houghton Mifflin Company. 279 pp.

The Secretariat of the Convention on Wetlands. 2020. *Ramsar List - The List of Wetlands of International Importance*. Gland, Switzerland. 55 pp.

Western Hemisphere Shorebird Reserve Network (WHSRN). 2019. *Sites in the Western Hemisphere Shorebird Reserve Network.* Accessed July 2020. https://whsrn.org/whsrn-sites/

6.2 GIS Data and Mapping References

This subsection includes references cited on the figure accompanying this report.

British Columbia Forests, Lands and Natural Resource Operations (BC MFLNRO). 2008. BC Freshwater Atlas Stream Network (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: July 2011. Last Update Check: January 20, 2014.

British Columbia Forests, Lands and Natural Resource Operations (BC MFLNRO). 2012. Digital Road Atlas (DRA) - Master Partially Attributed Road Data (digital file). Victoria, BC. Available: https://apps.gov.bc.ca/pub/dwds/home.so. Acquired: December 2015. Last Update Check: December 15, 2015.

ESRI. 2020. World Imagery map service (digital file). Redmond, WA. Available: via ArcGIS Online, visit http://www.esri.com/software/arcgis/arcgisonline. Web Map Service Layer Credits: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community (c) 2020 ESRI and its data suppliers. Accessed Online July 20, 2020.

Government of Canada. 2018. Aboriginal Lands, Canada (digital file). Edmonton, AB. Available: http://open.canada.ca/data/en/dataset/522b07b9-78e2-4819-b736-ad9208eb1067. Acquired: December 2019. Last Update Check: December 6, 2019.

Jacobs. 2020. Wildlife Survey Sites. Shapefiles provided to Trans Mountain Expansion Project, June 1, 2020.

Kinder Morgan Canada. 2012. Existing Trans Mountain Pipeline (digital file). Calgary, AB. Received via FTP. Acquired: May 9, 2012. Last Update Check: N/A.

Natural Resources Canada. 2007-2011. National Hydro Network (digital files). Sherbrooke, QC. Available: http://www.geobase.ca/geobase/en/data/nhn/index.html. Acquired: April 2012. Last Update Check: May 2012.Universal Pegasus International. 2017. Access Roads (digital file). Calgary, AB. Received via FTP. Acquired: August 23, 2017. Last Update Check: N/A.

Universal Pegasus International. 2020. Proposed KPs and Centerline AR3359 (digital files). Calgary, AB. Received via FTP. Acquired: May 21, 2020. Last Update Check: N/A.

Universal Pegasus International. 2018. Proposed KPs and Centerline SSEID005.19 (digital files). Calgary, AB. Received via FTP. Acquired: November 23, 2018. Last Update Check: N/A.

APPENDIX A

WILDLIFE SPECIES WITH PROVINCIAL OR FEDERAL CONSERVATION STATUS THAT HAVE POTENTIAL TO OCCUR NEAR THE REROUTE

TABLE A-1

WILDLIFE SPECIES WITH PROVINCIAL OR FEDERAL CONSERVATION STATUS THAT HAVE POTENTIAL TO OCCUR NEAR THE REROUTE

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Mammals				
American badger, *jeffersonii* subspecies, western population	*Taxidea taxus jeffersonii*	Open grasslands, aspen parkland and farmlands.	S1[1] Red[2] Priority 1[3] Goal 3[3]	Endangered[d,e]
American water shrew	*Sorex palustris*	Small streams, lakes, ponds, marshes, bogs and other lentic habitats.	S2S4[1] Blue[2]	--
Fringed myotis	*Myotis thysanodes*	Arid pine forests.	S3[1] Blue[2]	--
Little brown myotis	*Myotis lucifugus*	Roosts in buildings, large decaying trees and rock crevices/caves. Forages in a variety of habitats, especially wetlands.	--	Endangered[d,e]
Townsend's big-eared bat	*Corynorhinus townsendii*	Cultivated valleys bordered by open deciduous forests, brush or coniferous forests.	S3S4[1] Blue[2] Priority 2[3] Goal 2[3]	--
Birds				
American avocet	*Recurvirostra americana*	Mud flats, estuaries, ponds, marshes, lakeshores and sewage lagoons.	S2S3B[1] Blue[2] Priority 2[3] Goal 3[3]	--
American bittern	*Botaurus lentiginosus*	Freshwater sloughs, marshes, swamps and shallow lakes.	S3B[1] Blue[2] Priority 2[3] Goal 2[3]	--
Bank swallow	*Riparia riparia*	Open areas, often near water. Nesting near the top of steep banks associated with inland water, gravel pits and road embankments. Nesting in the same area in successive years is common.	--	Threatened[4,5]
Barn swallow	*Hirundo rustica*	Open areas near water. Often nest in overhangs of manufactured structures (*e.g.,* barns and bridges), cliffs, or caves.	S3S4B[1] Blue[2] Priority 2[3] Goal 2[3]	Threatened[4,5]
Bobolink	*Dolichonyx oryzivorus*	Open meadow and pasture land with moist areas of tall grass and hayfields.	S3B[1] Blue[2] Priority 2[3] Goal 2[3]	Threatened[4,5]
Common nighthawk	*Chordeiles minor*	Open forest and forest clearings (*e.g.,* logged or burned areas and natural woodland clearings), grasslands, rock outcrops, and flat gravel rooftops of buildings. Typically nest in open areas near logs, boulders, grassy clumps and shrubs.	Priority 2[3] Goal 2[3]	Threatened[4] Special Concern[5]
Eared grebe	*Podiceps nigricollis*	Marshes, ponds and lakes.	S3B[1] Blue[2]	--
Evening grosbeak	*Coccothraustes vespertinus*	Coniferous (primarily spruce and fir) and mixed coniferous-deciduous woodland, second growth and occasionally parks; in migration and winter in a variety of forest and woodland habitats and around human habitation.	--	Special Concern[5]
Flammulated owl	*Psiloscops flammeolus*	Well-spaced Douglas firs of varying ages with an open understory.	S3B[1] Blue[2] Priority 2[3] Goal 2[3]	Special Concern[4,5]

TABLE A-1 Cont'd

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Great blue heron, herodias subspecies	*Ardea herodias*	Mature deciduous, coniferous or mixed forests near water.	S3B,S4N[1] Blue[2] Priority 2[3] Goal 2[3]	--
Horned grebe	*Podiceps auritus*	Shallow ponds and marshes. Nest along edge of emergent vegetation near open water.	--	Special Concern[4,5]
Horned lark, *merrilli* subspecies	*Eremophila alpestris merrilli*	Open grasslands with scattered low shrubs, grazed pasture, stubble fields and cultivated areas.	S3S4B[1] Blue[2]	--
Long-billed curlew	*Numenius americanus*	Large tracts of open grassland with low vegetative cover for nesting.	S3B[1] Blue[2] Priority 2[3] Goal 2[3]	Special Concern[4,5]
Northern Goshawk, *atricapillus* subspecies	*Accipiter gentilis atricapillus*	Mature mixedwood forest with high canopy closure.	S3S4[1] Blue[2] Priority 3[3] Goal 3[3]	--
Olive-sided flycatcher	*Contopus cooperi*	Forests and woodlands, burned areas with standing dead trees, taiga, subalpine coniferous forest and mixed coniferous-deciduous forest, especially near wetland areas.	S3S4B[1] Blue[2] Priority 2[3] Goal 2[3]	Threatened[4] Special Concern[5]
Rusty blackbird	*Euphagus carolinus*	River groves, wooded swamps and muskeg.	S3S4B[1] Blue[2] Priority 2[3] Goal 2[3]	Special Concern[4,5]
Sharp-tailed grouse, *columbianus* subspecies	*Tympanuchus phasianellus columbianus*	Bunchgrass grasslands, sagebrush flats, open Ponderosa pine, lodgepole pine and birch woodlands.	S2S3[1] Blue[2] Priority 2[3] Goal 1,3[3]	--
Short-eared owl	*Asio flammeus*	Rangelands, grasslands, near dry marshes, farmlands, low Arctic tundra, brushy fields and forest clearings.	S3B, S2N[1] Blue[2] Priority 2[3] Goal 2[3]	Special Concern[4,5]
Swainson's hawk	*Buteo swainsoni*	Rangeland, pastures, farmland and marshes.	S2B[1] Red[2] Priority 2[3] Goal 3[3]	--
Western screech-owl, *macfarlanei* subspecies	*Megascops kennicottii macfarlanei*	Lower elevation forested areas, frequently close to water.	S2[1] Blue[2] Priority 1[3] Goal 3[3]	Threatened[4,5]
Williamson's sapsucker	*Sphyrapicus thryoideus*	Forested areas at elevations between 850 and 1,300 m. Principally western larch, interior Douglas-fir and Ponderosa pine forests.	S3B[1] Blue[2] Priority 2[3] Goal 2[3]	Endangered[4,5]
Wilson's warbler	*Cardellina pusilla*	Semi-open areas in moist woodlands, bogs with scattered trees, willow and alder thickets, and areas with similar vegetation structure.	-- Priority 2[3] Goal 2[3]	--
Reptiles				
Gopher snake, *deserticola* subspecies	*Pituophis catenifer deserticola*	Prairie, brushland, woodland, coniferous forest, farmland.	S2S3[1] Blue[2] Priority 2[3] Goal 3[3]	Threatened[4,5]
Rubber boa	*Charina bottae*	Streambanks, thickets, grasslands, and montane forests; rocky outcrops, abundant coarse woody debris, abandoned rodent burrows and rock crevices.	-- Priority 1[3] Goal 2[3]	Special Concern[4,5]
Western yellow-bellied racer	*Coluber constrictor mormon*	Ponds, marshes, rivers, streams and irrigation ditches that have a rocky or muddy bottom.	S3[1] Blue[2] Priority 2[3] Goal 2[3]	Special Concern[4] Threatened[5]

TABLE A-1 Cont'd

Common Name	Scientific Name	Habitat	Provincial Designations	Federal Designations
Amphibians				
Western toad	*Anaxyrus boreas*	Forested areas, wet shrublands, avalanche slopes, meadows, clearcuts, streamsides, shallow pond edges; often with dense shrub cover.	S3S4[1] Yellow[2] Priority 2[3] Goal 2[3]	Special Concern[4,5]
Invertebrates				
Monarch	*Danaus plexippus*	Abandoned farmlands, roadsides and other open places where milkweed, goldenrod, asters and purple loosestrife grow.	S3B[1] Blue[2] Priority 2[3] Goal 2[3]	Special Concern[4] Endangered[5]

Sources: Banfield 1974; BC CDC 2020a, BC MOE 2009, 2011; Campbell et al. 1990; COSEWIC 2019; Corkran and Thoms 1996; Government of Canada 2019b; Matsuda et al. 2006; NatureServe 2020; Stebbins 1966.

Notes:

BC = British Columbia
BC CDC = British Columbia Conservation Data Centre

[1] Provincial (S) ranks are assigned by BC CDC (2020a). Only Ranks S1 to S3 or a combination involving S1 to S3 (*e.g.,* S3S4) are included in this table. All definitions below are adapted from NatureServe (2020).

S1 = Critically Imperiled: at high risk of extirpation in the province due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S2 = Imperiled: at risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S3 = Vulnerable: at moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

S4 = Apparently Secure: at a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

S#S# = Range Rank: a numeric range rank (*e.g.,* S2S3) is used to indicate the range of uncertainty about the status of the species (*e.g.*, S2S3) is used to indicate the range of uncertainty about the status of the species.

S#? = Inexact numeric rank: denotes inexact numeric rank.

N = Nonbreeding: refers to the nonbreeding population.

B = Breeding: refers to the breeding population.

[2] BC Provincial Lists (BC CDC 2020a). Only Red- and Blue-listed designations are included in this table.

Red List = includes any indigenous species and subspecies that is Extirpated, Endangered or Threatened in BC.

Blue List = includes any indigenous species and subspecies considered to be of Special Concern in BC. Elements are of Special Concern because of characteristics that make them particularly sensitive to human activities or natural events.

[3] Conservation goals and priorities established under the BC Conservation Framework (BC MOE 2009, 2011). This table only includes priorities 1 and 2.

Goal 1 = to contribute to global efforts for species and ecosystem conservation. This goal has a strong emphasis on global status, assigning higher priority to species that are globally at risk. Species that have disjunct populations in BC or are collapsing in BC also get higher priority.

Goal 2 = to prevent species and ecosystems from becoming at risk. This goal emphasizes species of moderate conservation concern, which are currently not at risk but are exhibiting downward trends and are likely to become at risk in the future if preventable measures are not taken.

Goal 3 = to maintain the full diversity of native species and ecosystems. This goal bases priority on Provincial status alone to ensure that Provincially at-risk species facing significant threats or declines are given the highest priority.

[4] The *SARA*. *SARA* establishes Schedule 1 as the list of species to be protected on all Federal lands in Canada. The Act also applies to all lands in Canada for Schedule 1 bird species cited in the *Migratory Birds Convention Act*. This table only includes designations of Endangered, Threatened and Special Concern.

Endangered = a species that is facing imminent extirpation or extinction.

Threatened = a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

Special Concern = a species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats.

[5] COSEWIC (2019). This table only includes designations of Endangered, Threatened or Special Concern.

Endangered = a species facing imminent extirpation or extinction.

Threatened = a species that is likely to become an Endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.

Special Concern = a species that may become a Threatened or an Endangered species because of a combination of biological characteristics and identified threats.

APPENDIX B

WILDLIFE SPECIES OBSERVED – JUNE 8 TO 18, 2020

TABLE B-1

WILDLIFE SPECIES OBSERVED – JUNE 8 TO 18, 2020

Common Name	Scientific Name	Conservation Status	Observation Type/Sign Used to Identify Species
Mammals			
American black bear	*Ursus americanus*	--	Scat
Bat spp.	--	--	Visual
Coyote	*Canis latrans*	--	Auditory
Least chipmunk	*Neotamias minimus*	--	Visual
Red squirrel	*Tamiasciurus hudsonicus*	--	Auditory
Striped skunk	*Mephitis mephitis*	--	Visual
Birds			
American robin	*Turdus migratorius*	--	Visual, auditory
Brown-headed cowbird	*Molothrus ater*	--	Auditory
Calliope hummingbird	*Selasphorus calliope*	--	Visual
Canada goose	*Branta canadensis*	--	Visual
Cassin's vireo	*Vireo cassinii*	--	Auditory
Chipping sparrow	*Spizella passerina*	--	Auditory
Common nighthawk	*Chordeiles minor*	Threatened[2] Special Concern[3]	Visual, auditory
Common raven	*Corvus corax*	--	Visual, auditory
Dark-eyed junco	*Junco hyemalis*	--	Visual, auditory
Dusky flycatcher	*Empidonax oberholseri*	--	Visual, auditory
Flycatcher spp.	--	--	Auditory
Golden-crowned kinglet	*Regulus satrapa*	--	Auditory
Hairy woodpecker	*Dryobates villosus*	--	Visual, auditory, nest
Hammond's flycatcher	*Empidonax hammondii*	--	Auditory
Hermit thrush	*Catharus guttatus*	--	Auditory
House wren	*Troglodytes aedon*	--	Auditory
Hummingbird spp.	--	--	Visual
MacGillivray's warbler	*Geothlypis tolmiei*	--	Auditory
Mallard	*Anas platyrhynchos*	--	Visual
Marsh wren	*Cistothorus palustris*	--	Visual, nest
Mountain bluebird	*Sialia currucoides*	--	Visual
Mountain chickadee	*Poecile gambeli*	--	Visual, auditory
Nashville warbler	*Leiothlypis ruficapilla*	--	Auditory
Northern flicker	*Colaptes auratus*	--	Auditory
Northern goshawk	*Accipiter gentilis atricapillus*	Blue[1]	Visual
Olive-sided flycatcher	*Contopus cooperi*	Blue[1] Threatened[2] Special Concern[3]	Auditory
Orange-crowned warbler	*Leiothlypis celata*	--	Auditory
Owl spp.	--	--	Visual
Pileated woodpecker	*Dryocopus pileatus*	--	Auditory, foraging sign
Pine siskin	*Spinus pinus*	--	Visual, auditory
Red-breasted nuthatch	*Sitta canadensis*	--	Auditory
Red-naped sapsucker	*Sphyrapicus nuchalis*	--	Visual, auditory
Red-tailed hawk	*Buteo jamaicensis*	--	Visual
Red-winged blackbird	*Agelaius phoeniceus*	--	Visual
Ring-necked duck	*Aythya collaris*	--	Visual
Ruby-crowned kinglet	*Regulus calendula*	--	Auditory
Ruffed grouse	*Bonasa umbellus*	--	Visual, auditory
Rufous hummingbird	*Selasphorus rufus*	--	Visual
Savannah sparrow	*Passerculus sandwichensis*	--	Auditory
Song sparrow	*Melospiza melodia*	--	Auditory
Sparrow sp.	--	--	Visual, nest

TABLE B-1 Cont'd

Common Name	Scientific Name	Conservation Status	Observation Type/Sign Used to Identify Species
Spotted sandpiper	*Actitis macularius*	--	Visual
Spotted towhee	*Pipilo maculatus*	--	Auditory
Swainson's hawk	*Buteo swainsoni*	Red[1]	Visual
Swainson's thrush	*Catharus ustulatus*	--	Auditory
Townsend's solitaire	*Myadestes townsendi*	--	Auditory
Townsend's warbler	*Setophaga townsendi*	--	Auditory
Tree swallow	*Tachycineta bicolor*	--	Visual
Vesper sparrow	*Pooecetes gramineus*	--	Visual, auditory
Warbling vireo	*Vireo gilvus*	--	Auditory
Western tanager	*Piranga ludoviciana*	--	Auditory
Western wood-pewee	*Contopus sordidulus*	--	Auditory
White-breasted nuthatch	*Sitta carolinensis*	--	Visual, auditory
Williamson's sapsucker	*Sphyrapicus thryoideus*	Blue[1] Endangered[2,3]	Visual, auditory
Wilson's warbler	*Cardellina pusilla*	--	Visual, auditory
Yellow warbler	*Setophaga petechia*	--	Visual, auditory
Yellow-rumped warbler	*Setophaga coronata*	--	Visual, auditory
Reptiles			
Garter snake spp.	*Thamnophis sp.*	--	Visual
Common garter snake	*Thamnophis sirtalis*	--	Visual
Northern alligator lizard	*Elgaria coerulea*	--	Visual
Terrestrial garter snake	*Thamnophis elegans*	--	Visual
Amphibians			
Columbia spotted frog	*Rana luteiventris*	--	Visual
Long-toed salamander	*Ambystoma macrodactylum*	--	Visual
Northern pacific treefrog	*Pseudacris regilla*	--	Visual, auditory
Western toad	*Anaxyrus boreas*	Special Concern[2,3]	Visual

Notes:

[1] BC Provincial designations include Red- and Blue-listed designations assigned in the Provincial List (BC CDC 2020a).

[2] Listed as Endangered, Threatened or Special Concern on Schedule 1 of the *SARA* (Government of Canada 2019c).

[3] Designated as Endangered, Threatened or Special Concern by COSEWIC (2019).

sp. = *species*; this abbreviation is used when the species cannot be differentiated based on the observed wildlife sign.

Status designations are listed only for the designations previously noted. Where the status is denoted by "--", the previously noted Provincial or Federal status designations are not applicable for the species.

APPENDIX C

PHOTO PLATES

Plate C-1. View near AK 12.28 showing typical forest crossed by the Reroute.

Plate C-2. View near AK 9.62 showing typical open pasture crossed by the Reroute.

Plate C-3. Example suitable nest tree for Williamson’s sapsucker located near AK 16.29.

Plate C-4. Suitable hibernacula habitat for snakes observed along a rocky slope approximately 42 m south of the centreline near AK 2.30.

Plate C-5. View of inactive den observed 9 m northwest of the centreline near AK 5.59.

APPENDIX E

SOILS TECHNICAL DATA REPORT

SOILS TECHNICAL DATA REPORT FOR THE COLDWATER WEST ALTNERNATIVE REROUTE FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

September 2020
Doc Control # 01-13283-S5A-M002-EV-RPT-0011

Prepared for:

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

McTavish Resource & Management
Consultants Ltd.
Unit 203, 19292 60 Avenue, Surrey BC
V3S 3M2 Canada T: 604.510.4332

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
ALR	Agricultural Land Reserve
the Application	Facilities Application under Section 52 of the *Canadian Energy Regulator Act*
BC	British Columbia
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
cm	centimetre(s)
Coldwater	Coldwater Indian Band
Coldwater IR	Coldwater Indian Reserve No. 1
CPCN	Certificate of Public Convenience and Necessity
EPP	Environmental Protection Plan
ESA	Environmental and Socio-economic Assessment
IR	Information Request
km	kilometre(s)
KP	Kilometre Post
m	metre(s)
NEB	National Energy Board
PAg	Professional Agrologist
the Project or TMEP	Trans Mountain Expansion Project
the Reroute	proposed approximately 18.4 km Reroute of the Project
TMPL	Trans Mountain Pipeline system (existing)
Trans Mountain	Trans Mountain Pipeline ULC

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

1.0 INTRODUCTION

Trans Mountain Pipeline ULC (Trans Mountain) submitted a Facilities Application under Section 52 of the *National Energy Board Act* (the Application) to the Canada Energy Regulator (CER) (formerly the National Energy Board [NEB]) in December 2013 for the Trans Mountain Expansion Project (the Project or TMEP). A Certificate of Public Convenience and Necessity (CPCN) was issued by the CER on June 21, 2019.

Trans Mountain is proposing an approximately 18.4 km Reroute (the Reroute) from the current Project routing in proximity to the Coldwater Indian Reserve No. 1 (Coldwater IR) in British Columbia (BC). A western route option (the West Alternative Route) that avoided the Coldwater IR was considered during Project planning but was ultimately not selected as a preferred route (refer to Section 4.2 of the original Environmental and Socio-economic Assessment [ESA] [Filing ID A3S1L4]).

Coldwater Indian Band (Coldwater) has suggested that a refined West Alternative Route be considered, and Trans Mountain committed to conducting a feasibility study to resolve concerns raised by Coldwater regarding the route previously approved by the CER (the Approved Route). The approximately 18.4 km long Reroute deviates from the Approved Route at KP 931.4, re-joining at KP 946.88 (Appendix A). The Reroute was not included in the approved pipeline corridor; therefore, an Application for Variance under Section 190 of the *Canadian Energy Regulator Act* (*CER Act*) is required to vary the CPCN to reflect changes to the previously-approved Application.

Trans Mountain is proposing two trenchless crossings of the Coldwater River – one at the north end and one at the south end of the Reroute. In the Western Feasibility Study, filed in April 2020, Trans Mountain put forward plans to use a horizontal directional drill (HDD) crossing method for both crossings. Since that time, and with the benefit of additional geotechnical drilling results, Trans Mountain has decided to implement alternate trenchless construction methods for the northern crossing due to challenging geotechnical conditions in that area. These alternative and preferred methods are by Direct Pipe® Installation (DPI) and, as a contingency should the DPI prove infeasible, micro-tunnelling. Trans Mountain's primary considerations are to install the crossing in a manner that avoids disturbance to the Coldwater River, while also reducing the technical risks of the crossing based on the geotechnical conditions.

As part of the feasibility study, a soil assessment was completed within the Reroute alignment footprint. The objectives of the soil assessment (including desktop review, field survey and laboratory analysis) were to:

- Identify, delineate, and confirm soil classifications and (if applicable) published BC Soil series within the Reroute study area
- Characterize soils conditions in the Reroute study area including physical and chemical properties
- Define soil erosion potential
- Develop soil handling procedures across the Reroute
- Provide details on soil reclamation potential for existing soils along the Reroute

Mitigation measures to be applied for soils are provided in the Project-specific Environmental Protection Plan (EPP) (Filing ID C01961).

Environmental Alignment Sheets are provided in Appendix B of the ESA clearly depicting the Reroute and summarizing the pertinent environmental information gathered during field surveys completed to date, desktop research and associated key mitigation measures.

2.0 METHODS

The soil assessment was designed to identify, delineate, characterize soil conditions within the study area. Soils were classified per the Canadian System of Soil Classification. The assessment included a desktop review and field survey. Field data collection methods aligned with the RIC (1995) Soil Inventory Methods for British Columbia and were consistent with *Soils Technical Report for the Trans Mountain Expansion Project* (Mentiga Pedology Consultants Ltd. [Mentiga], 2013).

2.1 Study Area Spatial Boundaries

The study area for the soil survey included the 18.4 km proposed Reroute alignment footprint. The footprint is comprised of a 45 m pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace); temporary access roads (assumed to use existing access, where practical); and valves (assumed to be within the disturbed right-of-way).

2.2 The Canadian System of Soil Classification

Soils in Canada are classified according to the Canadian System of Soil Classification (Soil Classification Working Group, 1998). This system differentiates all known soil taxa in Canada based on their properties (chemical, physical, biological). The defined taxa are organized in a hierarchical manner, from general to specific: *Order, Great Group, Subgroup, Family,* and *Series.*

2.3 Desktop Review

Prior to the field survey, a desktop review was carried out to determine soil map units (SMUs) and develop the field-sampling layout across the proposed alignment.

A SMU is a conceptual entity that groups recurring map delineations of soil taxa across a landscape. A map delineation is a polygon that delineates the boundaries of a segment of the soil landscape that is recognized by the soil survey. For this assessment, SMUs were identified by using available topographic imagery and ground-truthed in the field. Within each SMU, map delineations (polygons) were outlined by identifying the soil series that have been mapped for the provincial soil survey (Government of BC, 2018). Based on this approach, ten SMUs were delineated across 14 mapped soil series polygons.

The Survey Intensity Level implemented for the project was a hybrid between Survey Intensity Level II to III, according to the RIC (1995) Soil Inventory Methods for BC. The RIC (1995) criteria for identifying survey intensity level is defined by the inspection intensity and the method of investigation. Soil pits met an inspection intensity of Level II on agricultural land (one inspection in at least 90% of delineations [one per 2-20 ha]) and soil pits off agricultural met the inspection intensity of Level III (one inspection in at least 60% of delineations [one per 20-200 ha]) soil pits met the method of investigation criteria for Level II. All soil pits installed met the criteria Level II for methods of investigation, including profile descriptions, samples, and laboratory analysis for all major soils.

After establishing the SMUs and polygons the number of soil pits required to meet (or exceed) the survey level intensity was established. This resulted in 24 soil pits across the 18.4 km linear Reroute alignment, meeting the Soil Intensity Level II to III requirements (as described above).

Additional sources reviewed include the following:

- Soils of the Ashcroft Map Area (Young, Fenger & Luttmerding, 1992)
- Canadian Soil Information Service – Soils of British Columbia (Government of Canada, 2013)
- The Canadian System of Soil Classification (Soil Classification Working Group, 1998)

2.4 Field Data Collection

The field survey was carried out between July 13 and July 16, 2020. Soil pits were installed at the pre-determined locations using a shovel Each pit was excavated into the C horizon or until shovel refusal. The field data collection was consistent with those used by Mentinga (2013) to prepare the *Soils Technical Report for the Trans Mountain Expansion Project*. At each soil pit, the following data were collected[1]:

- Parent material(s)
- Depth to impenetrable layer (bedrock, compact drift, etc.; cm)
- Depth to water table (cm)
- Depth to seepage (cm)
- Soil drainage class
- Humus horizons
- Horizon identification (label)
- Horizon thickness (cm)
- Munsell colour of each horizon
- Texture
- Structure
- Consistence
- Coarse fragment content (%) and description
- Mottles: colour, size, contrast
- Rooting depth (cm)
- Slope position
- Slope %
- Aspect

Soil samples were laboratory tested for chemical properties including particle size analysis (texture), micro and macronutrient content, organic matter content, salinity, and pH at Element Laboratory in Surrey, BC.

2.5 Evaluation of Soils for Erosion, Instability and Reclamation Potential

Based on the desktop review and the field survey, the soil handling protocol and evaluation of soils for reclamation and erosion potential has been determined using the following procedures.

2.5.1 Evaluation of Soils for Compaction and Rutting Potential

All soils are susceptible to compaction and rutting if unfavorable moist/wet conditions occur during construction. Soils with fine textures (clays, silts) and/or with poor drainage are at a heightened risk.

Soils were evaluated for their compaction and rutting potential based on texture and drainage characteristics.

2.5.2 Evaluation of Soils for Erosion Potential

Soil erosion hazard can be defined as the “expected rapidity and amount of soil loss, by water and/or wind, that may be expected in an area following removal of the protective vegetation cover and failure to implement the proper erosion control measures”, (Mentiga, 2013). Erosion potential varies based on factors such as slope, wind exposure, rainfall and water pooling, and soil properties.

---

[1] Detailed soil description data collected per the methods in the *Field Manual for Describing Terrestrial Ecosystems* (Province of British Columbia, 2010).

The soil erosion potential was determined using the "Guidelines for Wind and Water Soil Erosion Hazard Ratings" as presented by Mentiga (2013) in Appendix D of the *Soils Technical Report for the Trans Mountain Expansion Project* and are provided in Appendix B of this document.

2.5.3 Evaluation of Soils for Trench Instability Potential

Soils with coarse-textures, high coarse-fragment content, or that are excessively wet may result in unstable trench walls when excavated vertically (Mentiga, 2013). Soils were evaluated for their instability potential based on their properties and the site conditions.

2.5.4 Evaluation of Soils for Reclamation Potential

The reclamation ratings for each SMU was determined using the "Guidelines for Reclamation Ratings" as presented by Mentiga (2013) in Appendix B of the *Soils Technical Report for the Trans Mountain Expansion Project* and are provided in Appendix C of this document.

Mentiga draws on the "Criteria for Evaluating Suitability of Topsoil Material for Revegetation in the Plains Region" from Soil Quality Criteria Relative to Disturbance and Reclamation by the Alberta Soils Advisory Committee (1987) which considers soil physical and chemical properties.

2.6 Soil Handling Protocol Development

The soil handling protocol for soil excavation was determined using the "Guidelines for Alternative Soil Handling Procedures During Pipeline Construction" as presented by Mentiga (2013) in Appendix C of the *Soils Technical Report for the Trans Mountain Expansion* Project and are provided in Appendix D of this document. This procedure takes into consideration topsoil thickness, subsoil quality, stoniness, salinity, and sodic bedrock conditions. Potential excavation techniques include 2-lift, 3-lift, overstripping and no stripping, or alternative protocols. The soil handling protocol for soil excavation will be noted on the Environmental Alignment Sheets.

The SMUs will also be delineated on the Environmental Alignment Sheets and are called Map Delineations (Appendix E). The label of a Map Delineation identifies a SMU in the numerator and the Topographic Class in the denominator. The SMU is named after the Soil Series (as determined in the BC Soil Survey) in the SMU. The topographic class is a number between 1 and 10 and corresponds to a range in slope percentage.

Soil phases may also be used to indicate important soil characteristics that may affect soil handling and reclamation potential and are denoted in lower-case letters before the Map Delineation in the numerator. Also indicated in the numerator (in parentheses) is the average depth or range in depth of the topsoil, in cm. An example of the SMU notation is as follows:

$$\frac{\text{TIM (15)}}{3}$$

This identifies Timber (TIM) soils on Topographic Class 3 (2-5% slopes) with an average depth of topsoil extending to 15 cm. Timber soils are Eluviated Eutric Brunisols that have developed from morainal till deposits.

General soil handling procedures for agricultural soils, disturbed soils, erosion-prone, and unstable soils are included.

3.0 SOIL SURVEY RESULTS

The land use of the majority of the proposed reroute consist of non ALR land that is primarily used for seasonal grazing. Areas identified in the ALR are being used either for seasonal grazing or forage production.

Soils observed on the Reroute alignment were comprised of Brunisols, Luvisols, Chernozems, and Regosols with parent material consisting of either till, morainal till, or fluvial deposits.

Soil textures range from loam, silty clay loam, sandy loam and sandy clay loam and are occasionally sandy loam or gravel. Coarse fragment content ranges from 0 to 65% and range from gravels to cobbles. These soils are generally well drained. Details on the soil profile for each soil pit are outlined in Appendix F. Laboratory results are provided in Appendix G.

Due to their properties, fine grained soils (silty clay loam) could be prone to soil compaction or rutting, while coarse grained soils (sandy loam) would have moderate to high potential for wind and/or water erosion (**Table 1**).

Soil topsoil depth and coarse fragment content varies greatly on the alignment. Thus, the suitability for reclamation potential ranges from unsuitable to good (Table 1).

The soil survey was limited by shovel refusal due to soil cementation and high coarse fragment content. Although soil pits were dug to a maximum of a one-meter depth where possible, shovel refusal at several soil pits prevented deeper subsoil horizons from being observed and described. Despite this limitation, the soil pit depth at all soil pits was adequate to confidently determine soil stripping procedures.

4.0 SOIL HANDLING

The following sections outline the soil handling protocols and recommendations for soils along the proposed Coldwater reroute alignment. Recommendations for SMUs along the alignment are provided in **Table 1.**

4.1 Soil Excavation Protocols

The following subsections outline soil excavation protocols. The extent of the soil handling procedure, and depths of lifts (if applicable) will be indicated in the SMU Designation on the Environmental Alignment Sheets.

4.1.1 Two-Lift

The two-lift procedure includes removal of the topsoil (upper 15 to 75 cm of material) in the first lift, and the remaining subsoils in the second lift. Soil from each lift shall be stored separately with adequate separation (*i.e.* at least 1 m) between topsoil and subsoil piles to prevent admixing.

4.1.2 Three-Lift

The three-lift procedure includes removal of the topsoil (upper 15 to 75 cm of material) in the first lift, removal of the next soil horizon in the second lift (typically between 15 and 30 cm thickness), and removal of the underlying soils beneath in the third lift. Soil from each lift shall be stored separately with adequate separation (*i.e.* at least 1 m) between topsoil and subsoil piles to prevent admixing. Areas where three-lift procedures are specified may require additional temporary working space (TWS) to accommodate storage.

4.1.3 Overstripping

Overstripping of the topsoil is recommended where topsoil thickness is shallow (*i.e.* <15 cm in depth), and the upper subsoil is higher quality than the lower subsoil and suitable for reclamation purposes per the criteria for evaluating soils for restoration as presented in Appendix B of the *Soils Technical Report for the Trans Mountain Expansion Project* (Mentinga, 2013) and in Appendix C of this document..

4.1.4 No Stripping

No stripping of the topsoil is recommended where the topsoil thickness is shallow (*i.e.* <15 cm in depth), and the upper subsoil is poorer quality than the lower subsoil and unsuitable for reclamation purposes per the criteria for evaluating soils for restoration as presented in Appendix B of the *Soils Technical Report for the Trans Mountain Expansion Project* (Mentinga, 2013) and in Appendix C of this document.

4.2 Additional Soil Handling Recommendations

4.2.1 Full-Width

The full-width soil handling procedure involves stripping of topsoil and/or root-zone material for the full-width of the right-of-way for restoration purposes, except where topsoil storage piles are to be placed (thus minimizing topsoil handling and loss). Where it exists, the total depth of topsoil, up to a maximum depth of 75 cm should be salvaged. Where topsoil does not exist, the root-zone material (upper 15-20 cm) should be salvaged. Topsoil and root-zone material is useful for restoration due to the higher organic matter content and natural seed bank and propagules that will aid in regeneration of native vegetation during restoration. Based on the soil series that occur on the Reroute alignment, the depth of topsoil to be stripped is distinguished from the subsoils by colour and/or texture. The average depth of topsoil is indicated in the in the SMU designation on the Environmental Alignment Sheets.

4.2.2 Handling of Agricultural Soils

It is recommended that agricultural soils, and/or lands within the Agricultural Land Reserve (ALR), be full width stripped, except where topsoil storage piles are to be placed (thus minimizing topsoil handling and loss), to prevent admixing of topsoil and subsoils. Prior to topsoil replacement during reclamation, the subsoil should be de-compacted and then levelled to break up the hard soils, homogenize residual spoil and subsoil to minimize potential for topsoil admixing and landscape issues. Monitoring of soil handling by a qualified registered Professional Agrologist (PAg) within agricultural land is recommended.

4.2.3 Handling of Disturbed Soils

On disturbed lands, no topsoil stripping may be required. All soils excavated from disturbed soils (including existing right of ways and roads) shall be stored separately from other salvaged soils and be stored on disturbed lands where possible. All excavated disturbed soils should be backfilled in the same area in which they were excavated. Prior to excavation of disturbed soil, they should be evaluated for contamination.

4.2.4 Handling of Erosion-Prone Soils

Coarse-textured soils are prone to wind erosion. Wind speeds required to initiate erosion of mineral soils vary between 25 and 50 kilometres per hour measured at 30 centimetres above the soil surface (Agriculture and Agri-Food Canada, 2020). Topsoils and/or root-zone material in areas identified as having high wind-erosion potential should not be salvaged under extremely windy conditions (*i.e.* >40 km hour). Mitigation measures to prevent erosion and soil loss of soil stockpiles, such as the application of tackifier, cover-cropping, and/or covering may be required.

Soils that occur on slopes that exceed 15% may be prone to water erosion. Silts, silt loams and loams are especially prone to water erosion, especially if they are exposed to higher amounts or precipitation. In these areas with these soil textures and slopes > 15%, water erosion protection measures may be needed to be installed to prevent soil loss. Prevention measures may include the installation of silt fencing, Curlex sediment logs, straw wattles, erosion mats/blankets, tackifier application, cover-cropping, and crimped straw placement, seeding perpendicular to water flow and increasing seeding density. Works should also take place in dry conditions (April-September) in erosion-prone areas, where possible. Handling of Soils Prone to Trench Instability in areas where soils properties are likely to result in trench instability, topsoil or root-zone materials should be salvaged over a wide enough area to prevent the loss of surface material.

Stored topsoil and/or root-zone material shall be placed far enough away from the trench so that if trench instability occurs the stored material will not be lost in the trench. Additionally, excavation shoring techniques may have to be implemented and should be readily available in areas identified as being prone to trench instability.

Table 1 Summary of Soils Erosion Potential, Compaction and Trench Instability Susceptibility, Soil Handling Protocol, and Suitability for Reclamation by SMU

SMU	MAPPED SOIL SERIES	SOIL PITS	APPROXIMATE REROUTE KM POINT (AK)	SOIL CLASSIFICATION	PARENT MATERIAL	DRAINAGE CLASS	TOPOGRAPHY CLASS[1]	SMU TOPSOIL DEPTH RANGE (CM)	COLOUR DIFFERENTIATION BETWEEN TOPSOIL AND SUBSOIL	EROSION RATING – WIND	EROSION RATING – WATER	SUSCEPTIBLE TO SOIL COMPACTION AND RUTTING (YES/NO)	SUSCEPTIBLE TO TRENCH INSTABILITY (YES/NO)	SOIL HANDLING PROTOCOL	SOIL SUITABILITY FOR RECLAMATION	COMMENTS
TIM	Timothy	1	0 – 0.5	Eluviated Eutric Brunisol	Morainal till	Well drained	6	15	Fair	Moderate	Moderate	No	Yes	3-Lift	Good	Stony subsoil (especially in C horizon, below 40 cm).
MQE	McQueen	2	0.5 – 1.3	Orthic Dark Brown Chernozem	Morainal till	Well drained	4	14	Fair	Moderate	Slight	No	No	2-Lift	Good	-
GD	Godey	3/3a	1.3 – 2.0	Eutric Brunisol	Fluvial	Well drained - Rapidly	4	20	Weak	Moderate	Slight	No	No	2-Lift	Fair	2 soil pits dug due to one disturbed site.
TIM	Timothy	4 – 8	2.0 – 6.9	Eluviated Eutric Brunisol	Morainal till	Well drained	2 – 6	7 – 19	Poor – Good	Moderate	M	No	Yes	2-Lift	Fair	-
TRC	Trachte	9 – 14	6.9 – 11.1	Orthic Brown Chernozem	Morainal till	Moderately well - Well drained	2 – 6	29 – 75	Good – Distinct	Moderate	Slight – High	No	No	2-Lift	Fair	Strip to colour change.
GIS-KAN	Gisborne - Kane	15 – 16	11.1 – 13.9	Eluviated Eutric Brunisol / Orthic Gray Luvisol	Morainal till	Well drained - Rapidly	5 – 6	7 – 8	Fair – Good	M-H	Moderate – High	No	Yes	No strip	Unsuitable	-
CNY	Connaly	17 – 19	13.9 – 16.35	Orthic Gray Luvisol	Morainal till	Moderately well - Well drained	2 – 7	8 – 55	Poor	Moderate	Moderate – High	No	No	2-Lift	Fair	Strip both A horizons together as one lift to colour change.
FCI	Frances I	20 – 21	16.35 – 17.5	Gleyed Cumulic Humic Regosol	Fluvial	I - Well drained	2	12 – 32	Fair – Distinct	Moderate	Slight	No	Yes	2-Lift	Good	-
CNY	Connaly	22	17.5 – 17.92	Orthic Gray Luvisol	Morainal till	Moderately well - Well drained	3	26	Fair	Moderate	Slight	No	No	2-Lift	Fair	Strip both A horizons together as one lift to colour change where they more than one occurs.
BRN	Britton	23	17.92 – 18.4	Gleyed Cumulic Humic Regosol	Morainal till	Well drained	5	40	Good	Moderate	Moderate	No	Yes	2-Lift	Fair	Strip both A horizons together as one lift to colour change.

1. Topography Class:

1	0-0.5%
2	>0.5 – 2%
3	>2-5%
4	>5-10%
5	>10-15%
6	>15-30%
7	>30-45%
8	>45-70%
9	>70-100%
10	>100

5.0 SUMMARY AND CONCLUSIONS

Trans Mountain Pipeline ULC is proposing an alternate alignment near the Coldwater IR in BC. The Reroute is approximately 18.4 km and deviates from the Approved Route at KP 931.4 and rejoins at KP 946.88.

The soil assessment was conducted to:

- Identify, delineate, and confirm soil classifications and (if applicable) published BC Soil series within the Reroute study area
- Characterize soils conditions in the Reroute study area including physical and chemical properties
- Define soil erosion potential
- Develop soil handling procedures across the Reroute
- Provide details on soil reclamation potential for existing soils along the Reroute

The soil assessment included a desktop review, field data collection, laboratory analysis and evaluation. The field data collection included the installation of 23 soil pits across the Reroute alignment to meet a Soil Intensity Level of II to III (intensity increased within agricultural land). Across the alignment, ten SMUs were delineated and evaluated for compaction and rutting potential, erosion potential, trench instability potential, and reclamation potential. Based on the results, a soil handling protocol was developed for each SMU that occurred along the Reroute alignment. Soil erosion potential, trench instability potential, reclamation potential and soil handling recommendations have been determined based on the guidelines outlined in *Soils Technical Report for the Trans Mountain Expansion Project* (Mentiga, 2013).

The land use of the majority of the proposed reroute consist of non ALR land that is primarily used for seasonal grazing. Areas identified in the ALR are being used either for seasonal grazing or forage production.

Soils observed on the reroute alignment were comprised of Brunisols, Luvisols, Chernozems, and Regosols with parent material consisting of either till, morainal till, or fluvial deposits. The soils along the proposed Reroute exhibit large variability in topsoil depths, topsoil and subsoil characteristics and topographic classes. These soil types range from deep A horizon formations in the Chernozem soil series, to shallow Luvisol soils with a high coarse fragment content.

Soil erosion potential, trench instability potential, reclamation potential and soil handling recommendations are summarized for each SMU in Table 1 of this document. It is recommended that a PAg oversee soil handling works (including but not limited to topsoil stripping, subsoil excavation, soil replacement, and grading) works in agricultural areas that are in and/or areas within the ALR.

6.0 REFERENCES

Agriculture and Agri-Food Canada. (2020). Soil Management – Wind Erosion. Retrieved from: https://www.agr.gc.ca/eng/agriculture-and-climate/agricultural-practices/soil-and-land/soil-management/?id=1370346218601 Accessed August 2020.

Alberta Soils Advisory Committee. (1987). Soil Quality Criteria Relative to Disturbance and Reclamation. Retrieved from: https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag9469/$FILE/sq_criteria_relative_to_disturbance_reclamation.pdf ; Accessed July 2020.

Province of British Columbia. (2010). *Field Manual for Describing Terrestrial Ecosystems*. 2nd ed. BC Ministry of Forests and Range and the Resource Inventory Branch of the BC Ministry of Environment: Victoria, BC.

Government of Canada. (2013). Canadian Soil Information Service – Soils of British Columbia. Available at: http://sis.agr.gc.ca/cansis/soils/bc/soils.html Accessed July 2020.

[Mentiga] Mentiga Pedology Consultants Ltd. (2013). *Soils Technical Report for the Trans Mountain Expansion Project*. REP-NEB-TERA-00002 11024

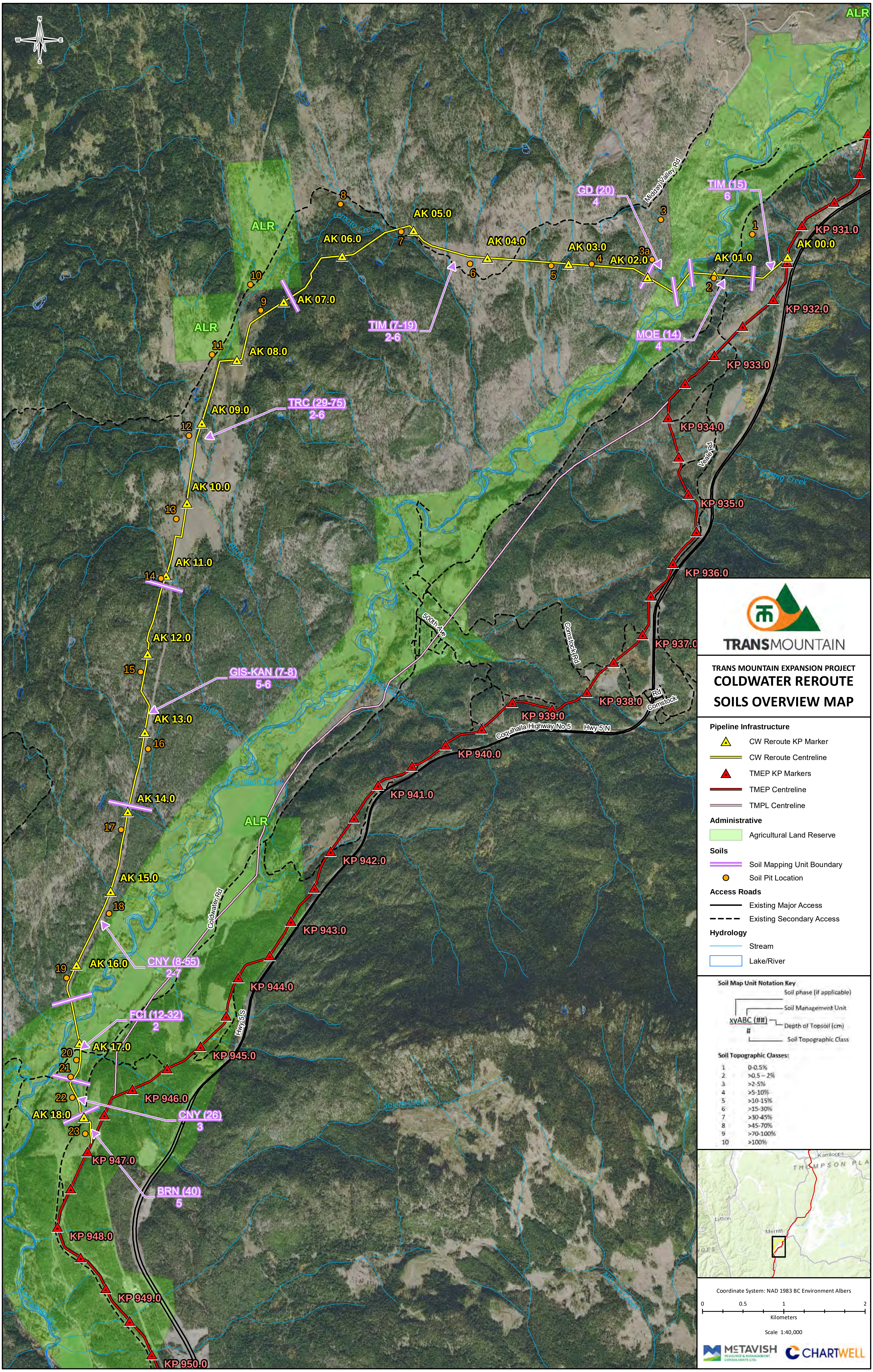
Soil Classification Working Group. (1998). *The Canadian System of Soil Classification*. 3rd ed. Research Branch – Agriculture and Agri-Food Canada.

[RIC] Resources Inventory Committee. (1995). Soil Inventory Methods for British Columbia. Government Publications Centre: Victoria, BC.

Young, G., Fenger, M.A., Luttmerding, H.A. (1992). *Soils of the Ashcroft Map Area*. Report No. 26. British Columbia Soil Survey. MOE Technical Report 23. Integrated Management Branch: Victoria, BC.

APPENDIX A

REROUTE SOILS OVERVIEW MAP



TRANSMOUNTAIN

TRANS MOUNTAIN EXPANSION PROJECT

COLDWATER REROUTE SOILS OVERVIEW MAP

Pipeline Infrastructure

▲	CW Reroute KP Marker
═	CW Reroute Centreline
▲	TMEP KP Markers
═	TMEP Centreline
═	TMPL Centreline

Administrative

🟩	Agricultural Land Reserve

Soils

═	Soil Mapping Unit Boundary
●	Soil Pit Location

Access Roads

─	Existing Major Access
- - -	Existing Secondary Access

Hydrology

─	Stream
▭	Lake/River

Soil Map Unit Notation Key

xyABC (##)
#

Soil phase (if applicable)
Soil Management Unit
Depth of Topsoil (cm)
Soil Topographic Class

Soil Topographic Classes:

1	0-0.5%
2	>0.5 – 2%
3	>2-5%
4	>5-10%
5	>10-15%
6	>15-30%
7	>30-45%
8	>45-70%
9	>70-100%
10	>100%

Coordinate System: NAD 1983 BC Environment Albers

0 0.5 1 2
Kilometers

Scale 1:40,000

McTAVISH RESOURCE & MANAGEMENT CONSULTANTS LTD. CHARTWELL

Document Path: M:\Forestry\DATA\17-719_McTavish_CollectorSoln\Projects\Coldwater Reroute Soil Mapping\Update 2020-09-11\TMEP - Coldwater Reroute - Soils Overview Map_2020-09-11.mxd

APPENDIX B

GUIDELINES FOR WIND AND WATER SOIL EROSION HAZARD RATINGS

Criteria for Evaluating Wind Soil Erosion Hazard in the Edmonton to Edson Area*

Rating	Characteristics
Slightly to None (S)	All soils with SiCL or CL surface textures and containing at least 3 percent organic matter.
Moderate (M)	All soils with L or SiL surface textures and containing at least 3 percent organic matter
High (H)	All soils with LS, S or SL surface textures and containing at least 3 percent organic matter

Criteria for Evaluating Water Soil Erosion Hazard in the Edmonton to Edson Area*

Rating	Characteristics
Slightly to None (S)	All soils with SiL and SiCL surface textures occurring on less than 5 percent slopes. All soils with L and SL surface textures occurring on less than 9 percent slopes. Little erosion can be expected with minimal disturbance. All poorly and very poorly drained soils on level and enclosed depressional positions of the landscape. No erosion can be expected; however, additions will occur if the surrounding upland is disbursed.
Moderate (M)	All soils with SiL and SiCL surface textures occurring on 5 to 9 percent slopes. All soils with L and SL surface textures occurring on 9 to 15 percent slopes. Rill erosion and some gullying can be expected.
High (H)	All soils with SiL and SiCL surface textures occurring on greater than 9 percent slopes. All soils with L and SL surface textures occurring on greater than 15 percent slopes. Extensive gullying can be expected when the protective vegetation is removed.

* These guidelines were developed by Al Twardy and are based on review of local literature, review of U.S.A. guidelines and practical experience.

APPENDIX C

GUIDELINES FOR RECLAMATION RATINGS

Criteria for Evaluating Suitability of Topsoil Material for Revegetation in the Plains Region.

Rating/Property	Good(G)	Fair (F)	Poor (P)	Unsuitable (U)
Reaction (pH)	6.5-7.5	5.5-6.4 & 7.6-8.4	4.5-5.4 & 8.5-9.0	<4.5 and >9.0
Salinity (E.C.) (dS/m)	<2	2-4	4-8	>8
Sodicity (SAR)	<4	4-8	8-12	>12*
Saturation (%)	30-60	20-30 60-80	15-20, 80-120	<15 and >120
Stoniness Class	S0, S1	S2	S3, S4	S5
Texture	FSL, VFSL, L, SL, SiL	CL, SCL, SiCL	LS, SiC, C**, S, HC***	
Moist Consistence	Very friable Friable	Loose	Firm, Very firm	Extremely firm
Organic Carbon (%)	>2	1-2	<1	
$CaCO_3$ Equivalent (%)	<2	2-20	20-70	>70

* Materials characterized by an SAR of 12 to 20 may be rated as Poor if texture is sandy loam or coarser and saturation % is less than 100.

** C – may be upgraded to Fair or Good in some arid areas

*** HC – may be upgraded to Fair or Good in some arid areas

Source: Soil Quality Criteria Relative to Disturbance and Reclamation; Alberta Soils Advisory Committee (1987).

Criteria for Evaluating Suitability of Subsoil Material for Revegetation in the Plains Region.

Rating/Property	Good(G)	Fair (F)	Poor (P)	Unsuitable (U)
Reaction (pH)	6.5-7.5	5.5-6.4 & 7.6-8.5	4.5-5.4 & 8.6-9.0	<4.5 and >9.0
Salinity (E.C.) (dS/m)	<3	3-5	5-10	>10
Sodicity (SAR)	<4	4-8	8-12	>12*
Saturation (%)	30-60	20-30, 60-80	15-20, 80-120	<15 and >120
Stone Content (% Volume)	<3	3-25	25-50	>50
Texture	FSL, VFSL, L, SiL, SL	CL, SCL, SiCL	S, LS, SiC, C, HC	Bedrock
Moist Consistence	Very friable Friable	Loose, Firm	Very firm	Extremely firm
Gypsum	The suitability criteria for sodicity (SAR) may be altered by the presence of high levels of either lime ($CaCO_3$) or gypsum ($CaSO_4$) in excess of other soluble salts.			
$CaCO_3$ Equivalent (%)				

* Materials characterized by an SAR of 12 to 20 may be rated as Poor if texture is sandy loam or coarser and saturation % is less than 100.

Source: Soil Quality Criteria Relative to Disturbance and Reclamation; Alberta Soils Advisory Committee (1987).

APPENDIX D

GUIDELINES FOR SOIL HANDLING PROCEDURES DURING PIPELINE CONSTRUCTION

CRITERIA FOR ALTERNATIVE SOIL HANDLING PROCEDURES

The criteria in this section are not presented in any order of priority. Also, there is a soil handling procedure decision flow chart at the end of this section which may be helpful in applying the criteria.

Soil Handling Unit

The soil handling unit is the soil map unit. All units identified on a map with a particular symbol (soil map unit delineation) should be handled in the same manner.

Soil Handling Unit Length

A soil handling unit length is equivalent to one soil map unit delineation at a map scale of 1:10,000. Except for situation where there are strongly contrasting soils or topographic features (e.g. bedrock ridge, stream channels, pot holes) the soil handling length would normally be a minimum of 100 m. The minimum soil handling length and the minimum soil map unit size are assumed to be equal.

Soil Sampling Criteria for Problem Soil Management

Sufficient soil sampling (based on professional judgment) should be completed to determine if the map unit delineation should be considered for alternative soil handling. If problem soils are anticipated, there should be at least one sample every 400 m.

Additional soil investigations or sampling may be required at a later time to better define a problem soil area identified by the pedologist in the initial survey. If an alternative soil handling candidate map unit delineation is less than or equal to 400 m in length **and** there are no soil chemistry data for that unit, the entire map unit delineation should be considered for alternative soil handling.

Further soil investigations or sampling is suggested as necessary to reduce the length of alternative handling procedures as requested or suggested by the field pedologist.

Topsoil Thickness Criteria

For topsoil stripping, the average topsoil thickness in a map unit delineation must be between 10 cm and 35 cm, and must be of "better quality" than the upper subsoil. Actual stripping depths can be modified during construction by on-site inspection. Again, special situations might suggest consideration of <10 cm.

Upper Subsoil Thickness Criteria

The average thickness of the upper subsoil of the soil map must be greater than 15 cm before separate subsoil lift handling is considered.

Maximum aggregate thickness of topsoil and upper subsoil to be separately handled is 50 cm. Therefore, the maximum amount of upper subsoil to be separately salvaged is 40 cm. This limit is set to allow for better planning of right-of-way width requirements.

Actual stripping depths can be modified during construction by on-site inspection.

Stone or Gravel Content (Coarse Fragments) Criteria

Alternate soil handling procedures will be considered when the upper subsoil is non-gravelly or non-stony material and;

i) the lower subsoil (50 cm to trench depth) has a coarse fragment (>2 mm in diameter) content of >35% if gravelly and >20% if cobbly (See Agriculture Canada 1987 for details).
ii) consolidated bedrock is encountered that would break into hard fragments with trenching.

Sodic Bedrock Criteria

Alternate soil handling procedures will be considered when the upper subsoil has an electrical conductivity (EC) of less than 8 dS/m and the lower subsoil includes sodic bedrock which, by definition, has a SAR greater than 15.

Subsoil Salinity

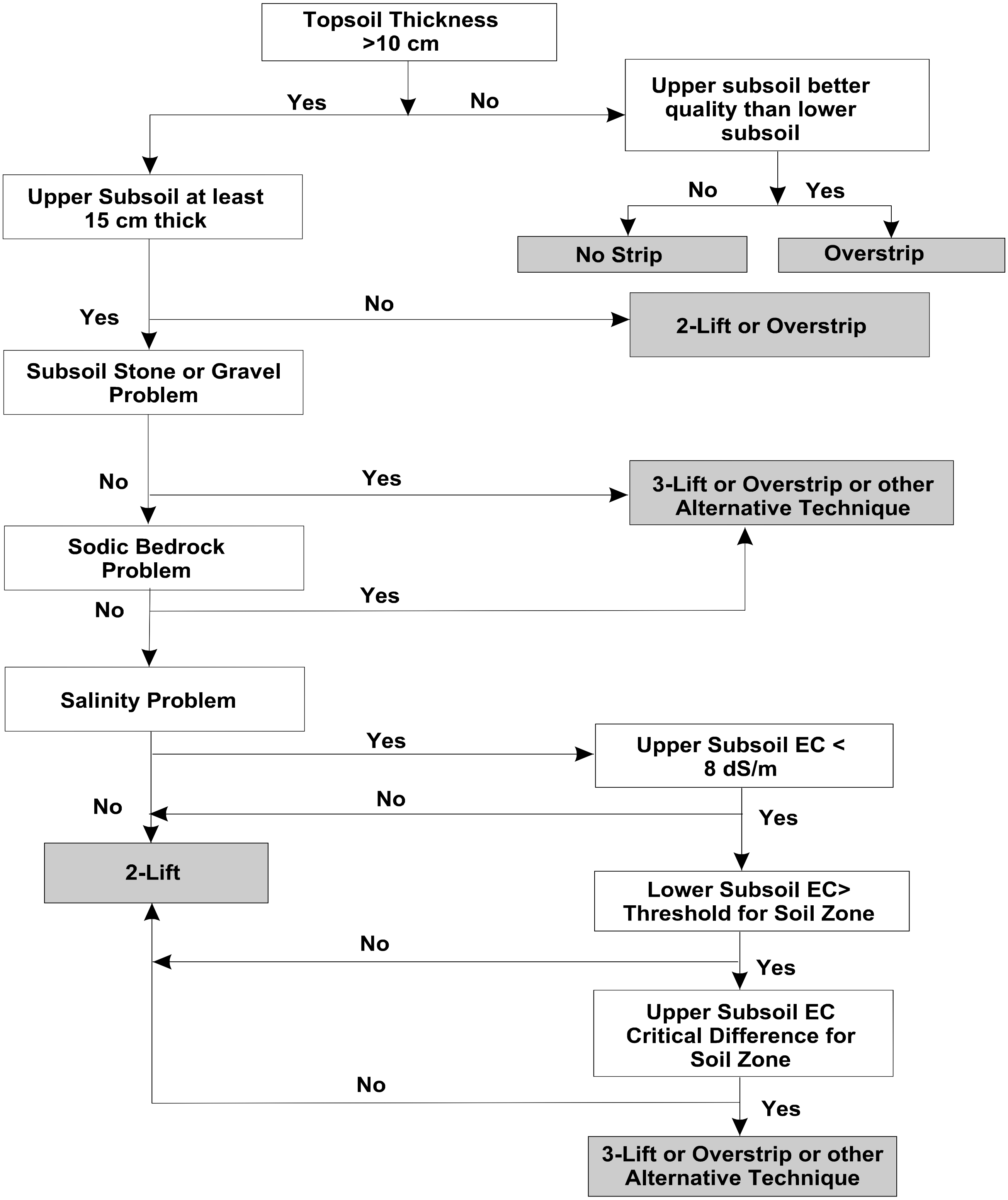
As a general guide for identifying problem areas and to avoid those areas with a minor amount of lower subsoil that meets the chemistry criteria identified in Section 5.9, alternative soil handling procedures should be considered when: lower subsoil with an EC of greater than 10 dS/m occupies 50% or more by depth of the material below 50 cm to trench depth. These numbers should not be taken as definitive but rather to alert the assessor of potential problems. Also, this criterion should not be dealt with in isolation from other characteristics such as the presence of Bn or Bnt horizons.

Salinity Criteria for Three-Lift

Three-lift procedures should be considered when the upper subsoil has an EC of less than 8 dS/m and the following conditions for salinity are met:

i) pre-construction EC of the upper subsoil must be less than 8dS/m,
ii) Threshold EC of lower subsoil must be exceeded (see table), and
iii) critical difference EC (lower subsoil minus upper subsoil) must be greater than or equal to 4 dS/m

Soil Zone	**Upper Subsoil EC (dS/m)**	**Lower Subsoil Threshold EC (dS/m)**	**Critical Difference EC (dS/m)**
Brown	<8	>5	≥4
Dark Brown	<8	>6	≥4
Others	<8	>8	≥4

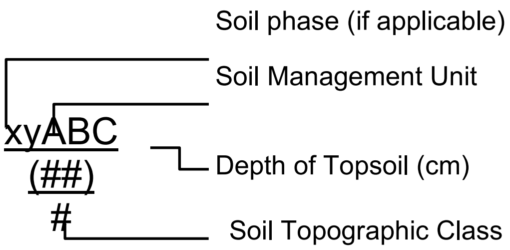


PROBLEM SOIL HANDLING PROCEDURE CHART

APPENDIX E

SOIL MAP UNIT DELINEATION NOTATION KEY

Soil Map Unit Notation Key:



Soil Topographic Classes:

1	0-0.5%
2	>0.5 – 2%
3	>2-5%
4	>5-10%
5	>10-15%
6	>15-30%
7	>30-45%
8	>45-70%
9	>70-100%
10	>100%

APPENDIX F

DETAILED SOIL SURVEY RESULTS

SOIL PIT	HORIZON	DEPTH (CM)	TEXTURE (HAND TEXTURED)	TEXTURE (LAB TEXTURED)	COARSE FRAGMENT CONTENT (%)	COARSE FRAGMENT NOTES	STRUCTURE	CONSISTENCE	COLOUR CODE	COLOUR	MOTTLING (ABUNDANCE, SIZE, CONTRAST)	ROOTING DEPTH (CM)	DEPTH TO SEEPAGE (CM)	DEPTH TO WATER TABLE (CM)	DRAINAGE CLASS	SLOPE (%)	ASPECT	COMMENTS
1	Ahe	0 - 15	Silty loam	-	0		Fine – Granular	Loose	10YR4/2	Dark Grayish Brow	-	35	-	-	Well drained	10	W	-
	Bm	15 - 43	Silty loam	-	10	Gravels	Single Grained	Loose	2.5Y2/3	Black	-							
	C	43- 64+	Sandy gravel	-	50	Gravels	Structureless	-	-		-							
2	Ap	0 - 14	Silty loam	Loam	0	-	Fine – Granular	Loose	10YR4/2	Dark Grayish Brown	-	65	-	-	Well drained	5	E	-
	Bm	14 - 39	Silty clay loam	Loam	0	-	Fine – Sub-angular blocky	Firm	10YR5/3	Brown	-							
	Ck	39 - 74+	Silty clay loam	-	4	Gravels	Medium – Sub-angular blocky	Very firm	2.5Y5/3	Light Olive Brown	-							
3	A	0 - 20	Disturbed road material	-	-	-	-	-	-		-	-	-	-	-	-	-	Disturbed road area.
3a	Ah	0-20	Silty loam	-	5	Stones	Sub-angular blocky	Loose	-	-	-	40	-	-	Well drained	-	-	-
	Bm	20-51	Loam	-	10	Cobbles	Sub-angular blocky	Firm	-	-	-							
	Ck	51-90+	Loam	-	10	Cobbles	Sub-angular blocky	Firm	-	-	-							
4	Ah	0 - 7	Silty loam	-	15	Gravels	Fine – Granular	Loose	10YR2/2	Very Dark Brown	-	33	-	-	Well drained	5	SE	-
	Ae	7 - 17	Silty loam	-	35	Cobbles	Fine – Granular	Loose	10YR4/3	Brown	-							
	Bm1	17- 35	Silty clay loam	-	40	Cobbles	Sub-angular blocky	Firm	10YR5/3	Brown	-							
	Bm2	35- 50+	Silty clay loam	-	40	Cobbles	Sub-angular blocky	Very firm	10YR5/3	Brown	-							
5	Ae	0 - 17	Silty loam	-	15	Gravels and Cobbles	Sub-angular blocky	Very firm	10YR3/2	Brown	-	40	-	-	Well drained	10	SE	-
	Bm1	17 - 27	Silty clay loam	-	40	Cobbles	Single grained	Loose	10YR4/2	Dark Grayish Brown	-							
	Bm2	27 - 55+	Silty clay loam	-	60	Cobbles	Sub-angular blocky	Firm	7.5Y4/2	Brown	-							
6	Ae	0 - 10	Silty loam	Loam	15	Cobbles and Stones	Fine – Granular	Loose	10YR3/1	Very Dark Gray	-	35	-	-	Well drained	15	S	-
	Bm	10 - 39	Sandy loam	-	30	Cobbles	Single grained	Loose	7.5YR4/2	Brown	-							
	Ck	39 - 43+	Sandy loam	-	40	Gravels and Cobbles	Single grained	Loose	10YR4/3	Brown	-							
7	Ae	0-19	Silty loam	-	10	Gravels	Fine – Granular	Loose	7.5YR2.5/1	Black	-	58	-	-	Well drained	5	NE	-
	Bm1	19-30	Silty loam	-	30	Cobbles	Single Grained	Loose	10YR4/2	Dark Grayish Brown	-							
	Ck	30-50+	Silty loam	-	35	Cobbles	Single Grained	Loose	10YR5/2	Grayish Brown	-							
8	Ah	0-10	Silty loam	-	5	Cobbles	Fine – Granular	Loose	10YR3/1	Very Dark Gray	-	40	-	-	Well drained	8	N	-
	Bm	10-45	Silty clay loam	-	40	Gravels and Cobbles	Sub-angular blocky	Firm	2.5Y4/2	Dark Grayish Brown	-							
	Ck	45-55+	Silty clay loam	-	45	Gravels and Cobbles	Sub-angular blocky	Very firm	2.5Y5/4	Grayish Brown	-							
9	Ah	0-39	Silty loam	Loam	30	Stones	Fine – Granular	Loose	10YR2/2	Very Dark Brown	-	60	-	-	Well drained	5	NW	-
	Bm1	39-73+	Silty loam	-	20	Gravels and Cobbles	Single Grained	Loose	10YR4/3	Dark Grayish Brown	-							
10	Ah	0-35	Silty loam	-	12	Gravels	Fine – Granular	Loose	10YR2/1	Black	-	35	-	-	Well drained	10	NW	-
	Bm	35-53	Silty loam	-	15	Gravels	Sub-angular blocky	Firm	10YR4/2	Dark Grayish Brown	-							
	Ck	53-67+	Silty clay loam	-	10	Gravels	Sub-angular blocky	Firm	2.5Y2/2		-							
11	Ah	0-75	Silty loam	Loam	2	Gravels and Cobbles	Medium – Granular	Loose	2.5Y2/2	Black	-	75	-	-	Well drained	5	SE	-
	C	75-80+	Silty clay loam	-	25	Gravels	Sub-angular blocky	Firm	2.5Y4/2	Dark Grayish Brown	-							
12	Ah	0-29	Silty loam	-	5	Cobbles	Sub-angular blocky	Firm	10YR2/2	Very Dark brown	-	46	-	-	Well drained	5	SE	-

SOIL PIT	HORIZON	DEPTH (CM)	TEXTURE (HAND TEXTURED)	TEXTURE (LAB TEXTURED)	COARSE FRAGMENT CONTENT (%)	COARSE FRAGMENT NOTES	STRUCTURE	CONSISTENCE	COLOUR CODE	COLOUR	MOTTLING (ABUNDANCE, SIZE, CONTRAST)	ROOTING DEPTH (CM)	DEPTH TO SEEPAGE (CM)	DEPTH TO WATER TABLE (CM)	DRAINAGE CLASS	SLOPE (%)	ASPECT	COMMENTS
	Bm	29-44	Silty loam	-	10	Cobbles and Stones	Single grained	Loose	10YR3/4	Dark Yellowish Brown	-							
	C	44-55+	Silty loam	-	25	Gravels	Single grained	Loose	2.5Y4/3	Olive Brown	-							
13	Ah	0-40	Silty loam	Sandy Loam	7	Gravels and Cobbles	Fine – Granular	Loose	10YR2/2	Very Dark Brown	-	50	-	-	Moderately well drained	2	NW	-
	C	40-75+	Silty clay loam	-	10	Gravels and Cobbles	Sub-angular blocky	Friable	10YR3/2	Brown	-							
14	LFH	-5-0	Leaf Litter Layer	-	-	-	-	-	-		-	47	-	-	Moderately well drained	5	SE	-
	Ah	0-40	Silty loam	-	7	Gravels	Fine – Granular	Loose	10YR2/2	Very Dark Brown	-							
	Bm1	40-75+	Silty clay loam	-	35	Gravels and Cobbles	Sub-angular blocky	Friable	10YR3/4	Dark Yellowish Brown	-							
15	LFH	-3-0	Leaf Litter Layer	-	-	-	-	-	-		-	60	-	-	Rapidly drained	15	SE	-
	Ah	0-7	Silty loam	-	5	Gravels	Fine – Granular	Loose	10YR2/2	Very Dark Brown	-							
	Bm1	7-75+	SGL	Sandy loam	65	Gravels and Cobbles	Single grained	Loose	2.5Y4/1	Dark Gray	-							
16	Ae	0-8	Silty loam	-	55	Cobbles and Boulders	Fine – Granular	Loose	10YR4/2	Dark Grayish Brown	-	45	-	-	Well drained	15	SE	Shovel refusal at 30 cm; Large boulders; Compact subsoil.
	Bm	8-30+	Silty clay loam	-	45	Cobbles	Sub-angular blocky	Very firm	10YR5/4	Yellowish Brown	-							
17	Ah	0-8	Silty loam	-	5	Gravels	Fine – Granular	Loose	5Y2.5/1	Black	-	45	-	-	Well drained	20	SE	Possible disturbance in soil profile. Burned logging landing. 20% slope.
	Ae	8-37	Silty loam	-	25	Gravels and Cobbles	Medium – Sub-angular blocky	Hard	10YR3/4	Dark Yellowish Brown	-							
	Bt1	37-60+	Silty clay loam	Sandy Clay	18	Gravels and Cobbles	Fine – Sub-angular blocky	Hard	10YR3/4	Dark Yellowish Brown	-							
18	Ae1	0-12	Silty loam	-	15	Cobbles	Fine – Granular	Loose	10YR7/2	Light Gray	-	49	-	-	Well drained	32	SE	-
	Ae2	12-32	Silty loam	-	5	Gravels	Fine – Granular	Loose	10YR5/2	Grayish Brown	-							
	Bt	32-62	Silty loam	Loam	5	Gravels	Single grained	Loose	10YR8/7	Yellow	-							
	BC	62-82+	Sandy loam	Loam	2	Gravels	Single grained	Loose	10Y5/3	Brown	-							
19	Ah	0-30	Silty loam	-	3	Gravels	Sub-angular blocky	Slightly hard	5YR2.5/1	Black	-	80	-	-	Moderately well drained	8	SE	Hand exposed to 85 cm; Hand auger to 100 cm.
	Ae	30-55	Silty clay loam	-	2	Gravels	Sub-angular blocky	Friable	10YR3/1	Very Dark Gray	-							
	C	55-100+	Silt	Sandy Loam	4	Gravels	Single grained	Firm	10YR3/1	Very Dark Gray	-							
20	Ap	0-12	Silty loam	Loam	2	Cobbles	Fine – Granular	Loose	10YR4/2	Dark Grayish Brown	-	60	-	-	Imperfectly drained	3	N	-
	Ae	12-32	Silty loam	Loam	5	Gravels and Cobbles	Very fine – Granular	Loose	10YR8/3	Very Pale Brown	-							
	C1	32-77	Silty loam	-	0	-	Single grained	Loose	10YR3/4	Dark Yellowish Brown	-							
	C2	77-90+	Sandy loam	-	0	-	Single grained	Soft	10YR4/2	Very Dark Grayish Brown	-							
21	Ap	0-25	Silty loam	Loam	5	Gravels	Medium – Granular	Loose	10YR3/2	Very Dark Grayish Brown	-	40	-	-	Well drained	5	S	-
	C	25-70+	Silty loam	Sandy Loam	45	Gravels and Cobbles	Single grained	Loose	10YR4/3	Brown	-							
22	Ae	0-26	Silty loam	-	15	Cobbles	Fine – Granular	Loose	2.5Y5/2	Grayish Brown	-	55	-	-	Well drained	5	N	-
	Bt	26-70+	Silty loam	-	35	Cobbles	Fine – Sub-angular blocky	Weak firm	10YR5/3	Brown	-							
23	Ahe	0-4	Silty loam	-	8	Stones, Cobbles and Gravels	Granular	Loose	10YR3/2	Very Dark Grayish Brown	-	40	-	-	W	13	SE	Auger refusal at 54 cm due to cobbles stones; Cemented B
	Ae	4-40	Silty loam	-	35	Cobbles and Stones	Granular	Loose	10YR5/1	Gray	-							

SOIL PIT	HORIZON	DEPTH (CM)	TEXTURE (HAND TEXTURED)	TEXTURE (LAB TEXTURED)	COARSE FRAGMENT CONTENT (%)	COARSE FRAGMENT NOTES	STRUCTURE	CONSISTENCE	COLOUR CODE	COLOUR	MOTTLING (ABUNDANCE, SIZE, CONTRAST)	ROOTING DEPTH (CM)	DEPTH TO SEEPAGE (CM)	DEPTH TO WATER TABLE (CM)	DRAINAGE CLASS	SLOPE (%)	ASPECT	COMMENTS
	Bt	40-54+	Silty loam	-	30	Cobbles and Stones	Single grained	Loose	10YR6/1	Gray	-							horizon; 13% slope.

Pit 1

Pit 2

Pit 3

Pit 4

Pit 5

Pit 6

Pit 7

Pit 8

Pit 9

Pit 10

Pit 11

Pit 12

Pit 13

Pit 14

Pit 15

Pit 16



Pit 17



Pit 18



Pit 19



Pit 20

Pit 21

Pit 22

Pit 23

APPENDIX G

SOIL LABORATORY RESULTS

element

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

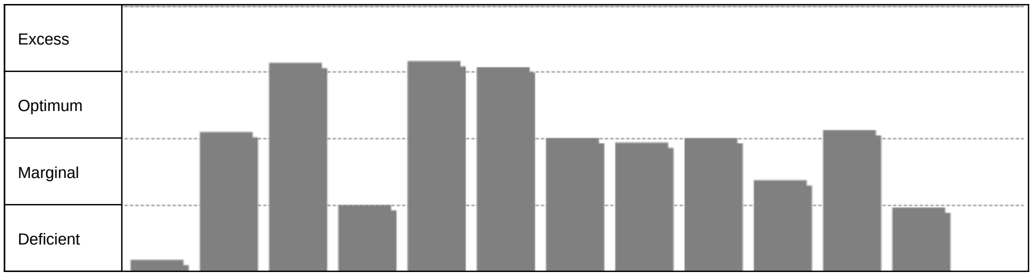
Bill To:	McTavish Resource &	Grower Name:	Coldwater Reroute	Lot Number:	1435622
Report To:	McTavish Resource &	Client's Sample Id:		Report Number:	2532083
		Field Id:	CR-2 Ap horizon	Date Received:	Jul 20, 2020
	2858 Bayview Street	Acres:		Disposal Date:	Aug 19, 2020
	Surrey, BC., Canada	Legal Location:		Report Date:	Jul 23, 2020
	V4A 2Z4	Last Crop:	Crop not provided	Arrival Condition:	
Agreement:	36394				

Nutrient analysis (ppm)

Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP
0" - 6"	3	28	571	2	2510	533	20.5	0.8	1	0.5	8.2	4	

Soil Quality

pH	EC(dS/m)	OM(%)	Sample#
7.3	0.2	6.7	7135499



pH	EC	OM
Alkaline	Extreme	High
► Neutral	Very High	► Normal
Acidic	High	Low
Very Acidic	Good ►	Very Low

	N*	P	K	S**
Total lbs/acre	7	57	1142	4
Estimated lbs/acre	14	57	1142	8

Texture *Loam* Hand Texture *n/a*

Sand 38.0 % Silt 42 % Clay 20 %

Ammonium n/a

BS 100 % CEC n/a

Ca 68.2 % Mg 23.8 % Na <0.7 % K 8.0 %

TEC 18.4 meq/100 g Na <30 ppm

Lime n/a Buffer pH Not Required Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

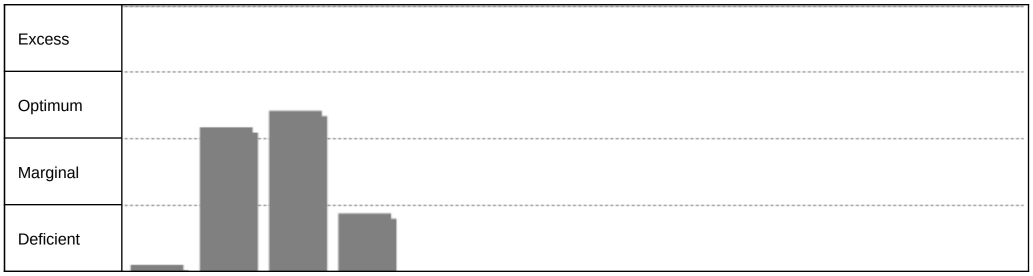
Bill To: McTavish Resource &
Report To: McTavish Resource &

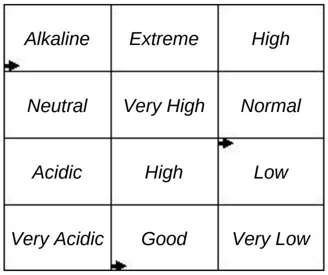
2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-2 B horizon
Acres:
Legal Location:
Last Crop: Crop not provided

Lot Number: 1435622
Report Number: 2532089
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)														Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	<2	31	297	2										7.9	0.1	1.9	7135505





Total lbs/acre	4	62	594	3
Estimated lbs/acre	8	62	594	7

Texture *Loam* Hand Texture *n/a*
Sand 28.0 % Silt 46.0 % Clay 25.7 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

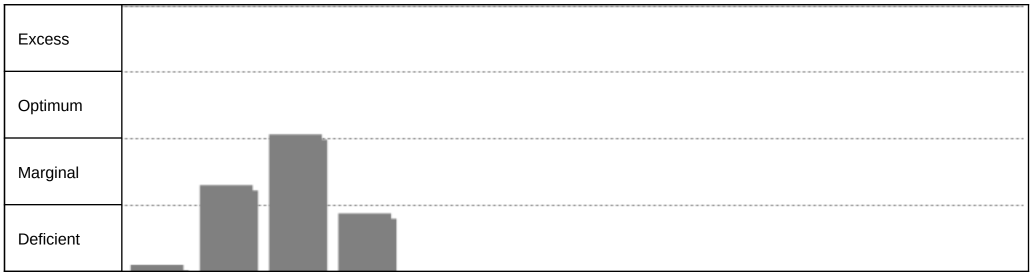
T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

Bill To:	McTavish Resource &	Grower Name:	Coldwater Reroute	Lot Number:	1435622
Report To:	McTavish Resource &	Client's Sample Id:		Report Number:	2532095
		Field Id:	CR-6 subsoil horzion	Date Received:	Jul 20, 2020
	2858 Bayview Street	Acres:		Disposal Date:	Aug 19, 2020
	Surrey, BC., Canada	Legal Location:		Report Date:	Jul 23, 2020
	V4A 2Z4	Last Crop:	Crop not provided	Arrival Condition:	
Agreement:	36394				

Nutrient analysis (ppm) | **Soil Quality**

Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	<2	18	173	2										7.6	0.1	1.3	7135511



Alkaline ➔	*Extreme*	*High*
Neutral	*Very High*	*Normal*
Acidic	*High*	➔ *Low*
Very Acidic	*Good* ➔	*Very Low*

	N*	P	K	S**
Total lbs/acre	4	36	345	3
Estimated lbs/acre	8	36	345	7

Texture *Loam* Hand Texture *n/a*
Sand 50.0 % Silt 33 % Clay 17 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

element

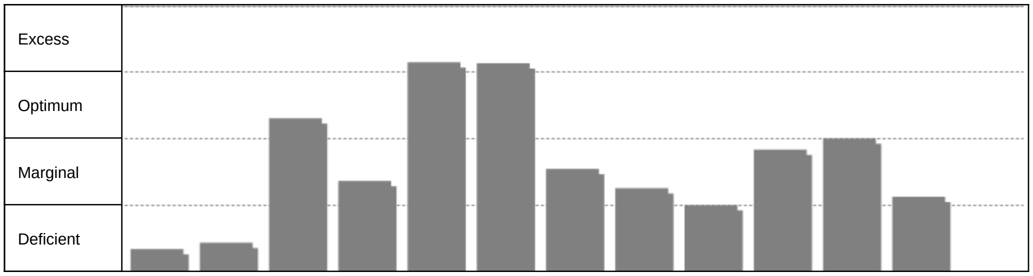
Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

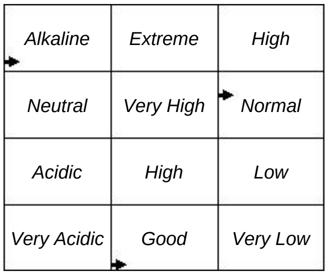
T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

Bill To:	McTavish Resource &	Grower Name:	Coldwater Reroute	Lot Number:	1435622
Report To:	McTavish Resource &	Client's Sample Id:		Report Number:	2532084
		Field Id:	CR-11 A horizon	Date Received:	Jul 20, 2020
	2858 Bayview Street	Acres:		Disposal Date:	Aug 19, 2020
	Surrey, BC., Canada	Legal Location:		Report Date:	Jul 23, 2020
	V4A 2Z4	Last Crop:	Crop not provided	Arrival Condition:	
Agreement:	36394				

Nutrient analysis (ppm)													Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	7	6	258	4	2360	757	7.7	0.4	<0.5	0.7	2.2	4		8.2	0.22	5.9	7135500





	N*	P	K	S**
Total lbs/acre	13	13	515	8
Estimated lbs/acre	27	13	515	16

Texture *Loam* Hand Texture *n/a*
Sand 46.0 % Silt 41.0 % Clay 12.7 %
Ammonium n/a

BS 100 % CEC n/a
Ca 61.9 % Mg 32.8 % Na 1.7 % K 3.5 %
TEC 19.0 meq/100 g Na 76 ppm

Lime n/a Buffer pH Not Required Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

element

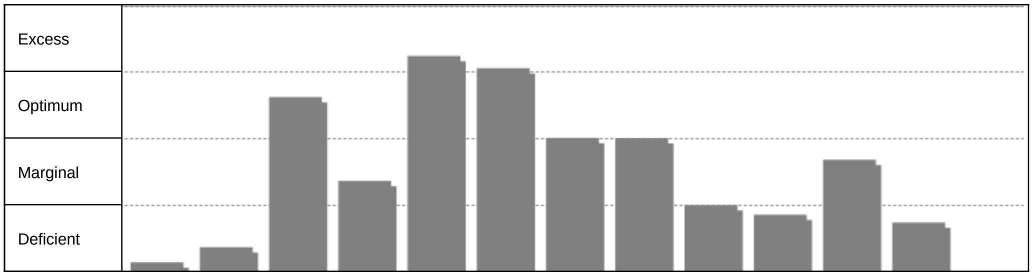
Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

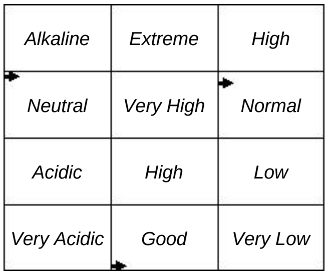
T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

Bill To:	McTavish Resource &	Grower Name:	Coldwater Reroute	Lot Number:	1435622
Report To:	McTavish Resource &	Client's Sample Id:		Report Number:	2532082
		Field Id:	CR-13 A horizon	Date Received:	Jul 20, 2020
	2858 Bayview Street	Acres:		Disposal Date:	Aug 19, 2020
	Surrey, BC., Canada	Legal Location:		Report Date:	Jul 23, 2020
	V4A 2Z4	Last Crop:	Crop not provided	Arrival Condition:	
Agreement:	36394				

Nutrient analysis (ppm)														Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	3	5	369	4	3210	481	21.8	0.8	<0.5	0.3	1.7	3		7.5	0.1	7.0	7135498





	N*	P	K	S**
Total lbs/acre	5	11	738	8
Estimated lbs/acre	11	11	738	16

Texture *Sandy Loam* Hand Texture *n/a*

Sand 58.0 % Silt 28.0 % Clay 13.5 %

Ammonium n/a

BS 100 % CEC n/a

Ca 76.0 % Mg 18.7 % Na 0.8 % K 4.5 %

TEC 21.1 meq/100 g Na 40 ppm

Lime n/a Buffer pH Not Required Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

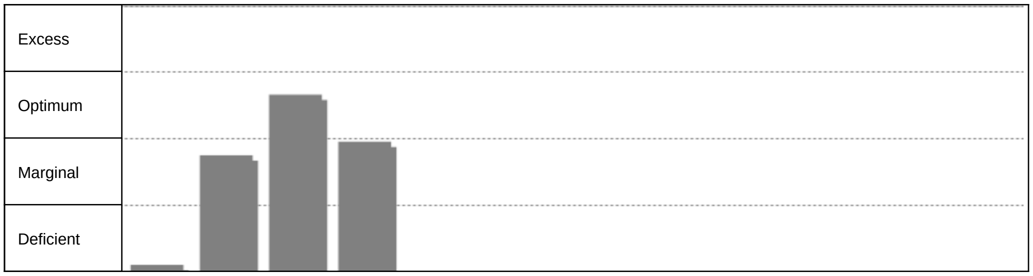
Bill To: McTavish Resource &
Report To: McTavish Resource &

2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-15 subsoil horizon
Acres:
Legal Location:
Last Crop: Crop not provided

Lot Number: 1435622
Report Number: 2532090
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)														Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	<2	23	382	7										6.6	0.09	2.0	7135506



Alkaline	*Extreme*	*High*
► *Neutral*	*Very High*	*Normal* ►
Acidic	*High*	*Low*
Very Acidic	*Good* ►	*Very Low*

	N*	P	K	S**
Total lbs/acre	4	45	764	14
Estimated lbs/acre	8	45	764	29

Texture *Sandy Loam* Hand Texture *n/a*
Sand 74.0 % Silt 19.0 % Clay 6.6 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

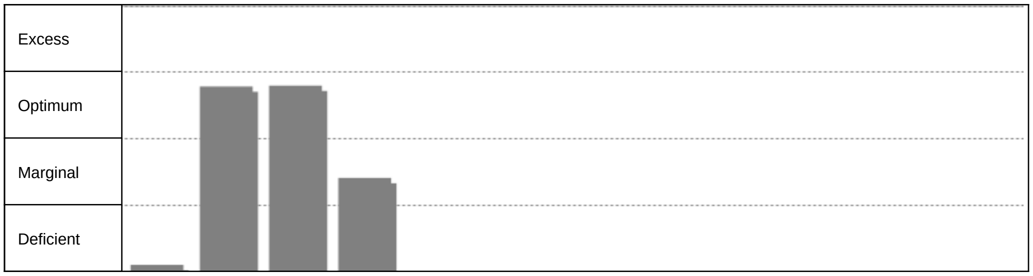
Bill To: McTavish Resource &
Report To: McTavish Resource &

2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-17 subsoil horizon
Acres:
Legal Location:
Last Crop: Crop not provided

Lot Number: 1435622
Report Number: 2532092
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)														Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	<2	53	430	4										8.1	0.28	3.1	7135508



Alkaline ▶	*Extreme*	*High*
Neutral	*Very High*	▶ *Normal*
Acidic	*High*	*Low*
Very Acidic	▶ *Good*	*Very Low*

Total lbs/acre	4	105	859	8
Estimated lbs/acre	8	105	859	17

Texture *Sandy Clay* Hand Texture *n/a*
Sand 48.0 % Silt 25.0 % Clay 27.5 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

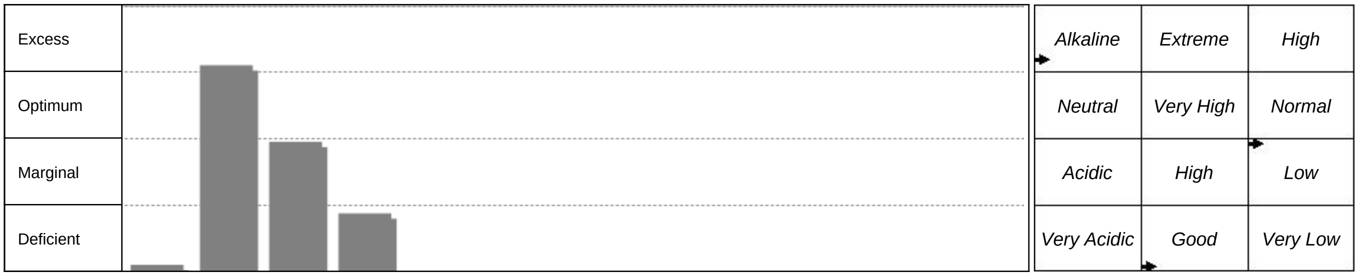
T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

Bill To:	McTavish Resource &	Grower Name:	Coldwater Reroute	Lot Number:	1435622
Report To:	McTavish Resource &	Client's Sample Id:		Report Number:	2532091
		Field Id:	CR-18 subsoil horizon	Date Received:	Jul 20, 2020
	2858 Bayview Street	Acres:		Disposal Date:	Aug 19, 2020
	Surrey, BC., Canada	Legal Location:		Report Date:	Jul 23, 2020
	V4A 2Z4	Last Crop:	Crop not provided	Arrival Condition:	
Agreement:	36394				

Nutrient analysis (ppm) / Soil Quality

Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	<2	>80	146	2										8.4	0.2	1.9	7135507



Total lbs/acre	4	160	293	3
Estimated lbs/acre	8	160	293	7

Texture *Loam* Hand Texture *n/a*
Sand 48.0 % Silt 42.0 % Clay 10.1 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

element

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

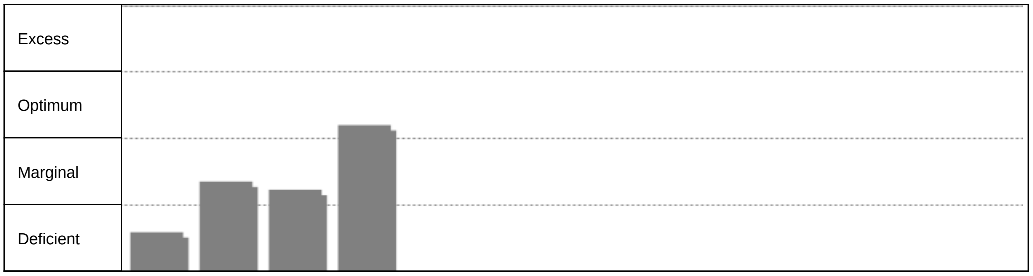
Bill To: McTavish Resource &
Report To: McTavish Resource &

2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-19 subsoil horizon
Acres:
Legal Location:
Last Crop: Crop not provided

Lot Number: 1435622
Report Number: 2532093
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)													Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	11	18	92	10										8.8	0.40	6.7	7135509



➔ Alkaline	Extreme	High
Neutral	Very High	➔ Normal
Acidic	High	Low
Very Acidic	➔ Good	Very Low

Total lbs/acre	23	37	184	20
Estimated lbs/acre	47	37	184	40

Texture *Sandy Loam* Hand Texture *n/a*
Sand 56.0 % Silt 36.0 % Clay 7.9 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

element

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

Bill To: McTavish Resource &
Report To: McTavish Resource &

2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-20 A horizon
Acres:
Legal Location:
Last Crop: Crop not provided

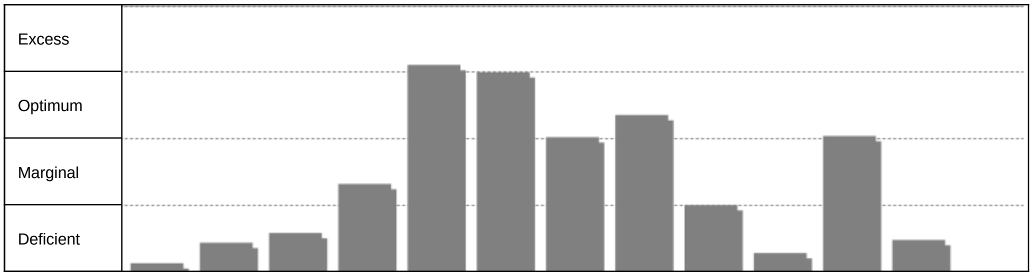
Lot Number: 1435622
Report Number: 2532087
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)

Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP
0" - 6"	2	6	43	4	1990	252	32.1	2.3	<0.5	0.1	3.9	2	

Soil Quality

pH	EC(dS/m)	OM(%)	Sample#
7.4	0.10	1.4	7135503



Alkaline	Extreme	High
► Neutral	Very High	Normal
Acidic	High	► Low
Very Acidic	Good ►	Very Low

	N*	P	K	S**
Total lbs/acre	5	13	87	7
Estimated lbs/acre	10	13	87	15

Texture *Loam* Hand Texture *n/a*
Sand 50.0 % Silt 39.0 % Clay 11.0 %
Ammonium n/a

BS 100.0 % CEC n/a
Ca 80.0 % Mg 16.7 % Na 2.4 % K 0.9 %
TEC 12.4 meq/100 g Na 69 ppm

Lime n/a Buffer pH Not Required Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

element

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

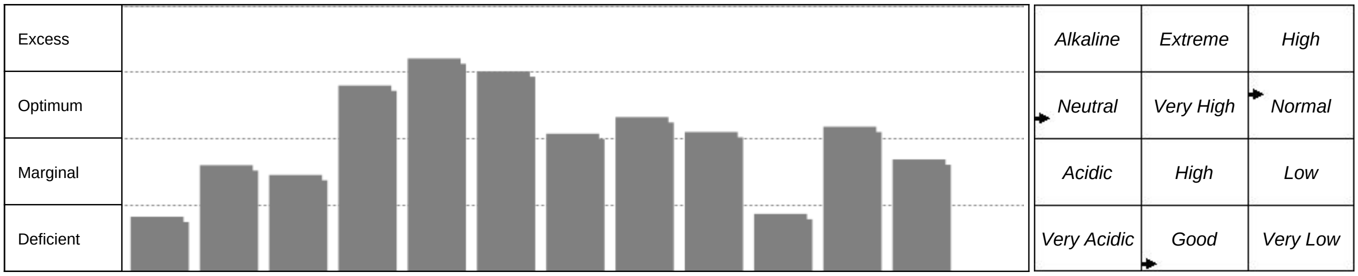
Bill To: McTavish Resource &
Report To: McTavish Resource &

2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-21 Ap horizon
Acres:
Legal Location:
Last Crop: Crop not provided

Lot Number: 1435622
Report Number: 2532086
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)														Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	16	21	109	17	2870	298	83.8	2.2	2.9	0.3	10.6	6.8		6.5	0.28	6.0	7135502



Total lbs/acre	32	42	218	35
Estimated lbs/acre	66	42	218	70

Texture *Loam* Hand Texture *n/a*
Sand 50.0 % Silt 33.0 % Clay 16.8 %
Ammonium n/a

BS 95.1 % CEC n/a
Ca 78.6 % Mg 13.4 % Na 1.5 % K 1.5 %
TEC 18.2 meq/100 g Na 62 ppm

Lime n/a Buffer pH 6.9 Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

element

Element
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: info.vancouver@element.com
W: www.element.com

Farm Soil Analysis

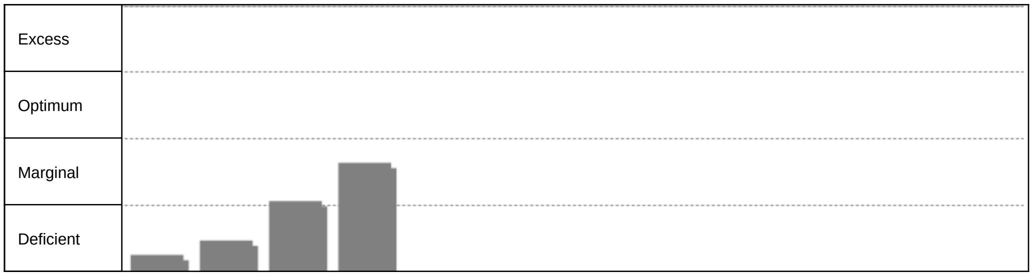
Bill To: McTavish Resource &
Report To: McTavish Resource &

2858 Bayview Street
Surrey, BC., Canada
V4A 2Z4
Agreement: 36394

Grower Name: Coldwater Reroute
Client's Sample Id:
Field Id: CR-21 subsoil horizon
Acres:
Legal Location:
Last Crop: Crop not provided

Lot Number: 1435622
Report Number: 2532088
Date Received: Jul 20, 2020
Disposal Date: Aug 19, 2020
Report Date: Jul 23, 2020
Arrival Condition:

Nutrient analysis (ppm)														Soil Quality			
Depth	N*	P	K	S**	Ca	Mg	Fe	Cu	Zn	B	Mn	Cl	BiCarbP	pH	EC(dS/m)	OM(%)	Sample#
0" - 6"	5	7	79	5										6.8	0.2	2.6	7135504



Alkaline	Extreme	High
➔ Neutral	Very High	Normal
Acidic	High	➔ Low
Very Acidic	➔ Good	Very Low

	N*	P	K	S**
Total lbs/acre	10	14	159	11
Estimated lbs/acre	20	14	159	22

Texture *Sandy Loam* Hand Texture *n/a*
Sand 59.0 % Silt 27.0 % Clay 13.9 %
Ammonium n/a

BS n/a CEC n/a
Ca n/a Mg n/a Na n/a K n/a
TEC n/a Na n/a

Lime n/a Buffer pH n/a Est. N Release n/a K/Mg Ratio n/a

**Nitrate-N **Sulfate-S n/a = not analysed*

RECOMMENDATIONS FOR BALANCED CROP NUTRITION

	Crop not provided				
Macro-nutrients	**Yield**	**N**	**P2O5**	**K2O**	**S**
Growing Condition		To be added (lbs/acre)			
Excellent					
Average					
Your Goal					
Removal Rate (Seed/Total)					
Micro-nutrients	Iron	Copper	Zinc	Boron	Manganese
To be added (lbs/ac)					

Comments:

Element uses nutrient extraction and analytical methods specifically developed for western Canadian soils.

The modified Kelowna extractant used to analyze key nutrients in this Farm Soil Analysis report is the standard method used in soil fertility research in western Canada. It is used in developing crop response curves to fertilizer in Alberta. The Element "RECOMMENDATIONS FOR BALANCED CROP NUTRITION" are based on those research data. Element recommendations are accurate but should not replace responsible judgement.

APPENDIX F

ASSESSMENT METHODOLOGY

ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT METHODOLOGY FOR THE COLDWATER WEST ALTERNATIVE REROUTE FOR THE TRANS MOUNTAIN PIPELINE ULC TRANS MOUNTAIN EXPANSION PROJECT

October 2020
FINAL
01-13283-S5A-M002-EV-RPT-0017

Prepared for:

TRANSMOUNTAIN

Trans Mountain Pipeline ULC
Suite 2700, 300 – 5th Avenue S.W.
Calgary, Alberta T2P 5J2
Ph: 403-514-6400

Prepared by:

Jacobs

Jacobs Consultancy Canada Inc.
205 Quarry Park Blvd SE
Calgary, Alberta T2C 3E7
Ph. 403-407-8700

ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Definition
Application	Facilities Application under Section 52 of the *National Energy Board Act*
BC	British Columbia
BGC	BGC Engineering Inc.
CEA	Canadian Environmental Assessment
CEA Act, 2012	*Canadian Environmental Assessment Act, 2012*
CER	Canada Energy Regulator
CER Act	*Canadian Energy Regulator Act*
Coldwater IR	Coldwater Indian Reserve No. 1
EA	Environmental Assessment
EAS	Environmental Alignment Sheet
EPP	Environmental Protection Plan
ESA	Environmental and Socio-economic Assessment
FEARO	Federal Environmental Assessment Review Office
GBA+	gender-based analysis plus
GHG	greenhouse gas
HORU	Human Occupancy and Resource Use
Jacobs	Jacobs Consultancy Canada Inc.
km	kilometre(s)
KP	Kilometre Post
LSA	Local Study Area
m	metre(s)
NEB	National Energy Board
NEB Act	*National Energy Board Act*
Coldwater West Alternative Reroute or Reroute	approximately 18.4 km reroute from the current Project routing in proximity to the Coldwater Indian Reserve No. 1 in British Columbia
Reroute Corridor	An approximate 300 m wide band generally centred on the pipeline centreline (*i.e.*, 150 m on both sides).
Reroute Footprint	A preliminary construction footprint that includes the right-of-way, temporary workspaces, access roads, and extra temporary workspace required for construction.
RSA	Regional Study Area
RSMT	Resource-Specific Mitigation Table
SARA	*Species at Risk Act*
TCE	total cumulative effect
TLRU	Traditional Land and Resource Use
TMEP or the Project	Trans Mountain Expansion Project
TMPL	Trans Mountain Pipeline (existing)
TNRD	Thompson-Nicola Regional District
Trans Mountain	Trans Mountain Pipeline ULC
Triton	Triton Environmental Consultants
VEC	Valued Ecosystem Component
VSC	Valued Social Component
Waterline	Waterline Resources Inc.
ZOI	zone-of-influence

TABLE OF CONTENTS

LIST OF TABLES

1.0 ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

Trans Mountain Pipeline ULC (Trans Mountain) is proposing an approximately 18.4 km reroute from the current Project (i.e., TMEP) routing in proximity to the Coldwater Indian Reserve No. 1 (Coldwater IR) in British Columbia (BC) (the Reroute or West Alternative Route). Pursuant to Section 190 of the *Canadian Energy Regulator Act* (*CER Act*), Trans Mountain is applying to vary Certificate OC-065 approving the construction and operation of Line 2 and associated facility details to reflect the West Alternative Reroute. Guide O of the *Filing Manual* states that applications to vary a certificate are generally required to reflect changes to previously approved applications, and the applicant must satisfy the filing requirements of the relevant *Filing Manual* Guide. Therefore, the Environmental and Socio-economic Assessment (ESA) methodology presented aligns with the requirements outlined in Guide A.2 of the CER *Filing Manual* (CER 2020a).

The description of the environmental setting (current state of the environment) within the Coldwater West Alternative Reroute (“the Reroute”) area, is compared against the Project description to assess potential environmental and socio-economic effects that might be caused by the Project. The environmental effects assessment uses the information provided in the environmental setting and Project description to:

- evaluate the environmental elements of importance in the Project area;
- identify and evaluate potential Project effects associated with each environmental element of importance; and
- develop appropriate technically and economically feasible site-specific mitigation and, where warranted, enhancement measures that are technically and economically feasible.

In addition, the environmental and socio-economic effects assessment determines the significance of potential residual effects resulting from construction and operations activities after taking into consideration proposed mitigation measures. Approved mitigation measures outlined in the Pipeline Environmental Protection Plan (EPP) (Condition 72, Filing ID C01961) and the Resource Specific Mitigation Tables (RSMTs) and Environmental Alignment Sheets (EASs) that will be updated prior to construction.

1.1 Environmental and Socio-Economic Assessment Methodology

The assessment evaluates the environmental and socio-economic effects of the construction, operations and future decommissioning and abandonment phases of the Project. The assessment method includes the following steps.

1. Describe the environmental and socio-economic setting.
2. Identify key environmental elements that could be affected.
3. Define the indicators and measurement endpoints to be used to assess each element.
4. Determine spatial and temporal boundaries for each element.
5. Identify potential environmental effects for each indicator.
6. Develop appropriate technically and economically feasible site-specific mitigation and, where warranted, restitution measures that are technically and economically feasible.
7. Predict anticipated residual effects.
8. Determine the significance of residual effects.

Steps 2 to 8 are described as follows in the applicable Methodology subsection. This effects assessment methodology is based on:

- the Federal Environmental Assessment Review Office's (FEARO's) *Responsible Authority's Guide to the Canadian Environmental Assessment Act: Part II The Practitioner's Guide* (FEARO 1994a);
- FEARO's *A Reference Guide for the Canadian Environmental Assessment Act: Addressing Cumulative Environmental Effects* (FEARO 1994b);
- FEARO's *A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether a Project is Likely to Cause Significant Environmental Effects* (FEARO 1994c);
- the Canadian Environmental Assessment (CEA) Agency *Cumulative Effects Assessment Practitioners Guide* (Hegmann et al. 1999);
- CEA Agency's *Incorporating Climate Change Considerations in Environmental Assessment* (CEA Agency 2003);
- CEA Agency's *Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act, 2012* (*CEA Act, 2012*) (CEA Agency 2013);
- the *CEA Act, 2012*;
- CER *Early Engagement Guide* (CER 2020b); and
- the CER *Filing Manual* (CER 2020a).

Subsequent steps of an effects assessment include a cumulative effects assessment, inspection and monitoring during construction and post-construction and follow-up monitoring.

The methods, indicators and spatial boundaries for the environmental elements are based on those established for the original ESA (Filing ID A3S1L4), based on feedback received from participants of the ESA Workshops, consultation with Appropriate Government Authorities and engagement with Indigenous groups.

On August 28, 2019, the *CER Act* came into force, replacing the *NEB Act*. Every decision or order made by the NEB is considered to have been made under the *CER Act* and may be enforced as such. Every certificate, license or permit issued by the NEB is considered to have been issued under the *CER Act.* Those instruments remain in force for the remainder of the period during which they would have been in force had the *CER Act* not come into force.

It was determined that new factors considered in the legislation (*e.g.,* gender-based analysis plus [GBA+], effects on Indigenous rights, greenhouse gas [GHG] emissions and climate change commitments and environmental obligations) will not be included in this assessment. In consideration of the level of consultation and engagement Trans Mountain has conducted to date, including the recent Phase III and Reroute-specific engagement, and the existing Project-specific Condition Plans, no additional potential interactions or effects are anticipated to occur as a result of construction or operation of the Reroute.

The current Project-specific Conditions applicable to the Reroute that are anticipated to reduce potential effects regarding these new factors include:

- Condition 13: Socio-economic Effect Monitoring Plan (GBA+, effects on Indigenous rights)
- Condition 16: Quantitative Geohazard Frequency Assessment (climate change commitments)
- Condition 39: Hydrogeological Study at Coldwater IR (effects on Indigenous rights)

- Condition 40: Rare Ecological Community and Rare Plant Population Management Plan (effects on Indigenous rights)
- Condition 41: Wetland Survey and Mitigation Plan (environmental obligations [*e.g.,* Federal Policy on Wetland Conservation])
- Condition 43: Watercourse Crossing Inventory (effects on Indigenous rights)
- Condition 44: Wildlife Species at Risk Mitigation and Habitat Restoration Plans (environmental obligations [*e.g., Species at Risk Act {SARA}*], effects on Indigenous rights)
- Condition 45: Weed and Vegetation Management Plan (effects on Indigenous rights)
- Condition 46: Contaminated Identification and Assessment Plan (effects on Indigenous rights)
- Condition 47: Access Management Plans (effects on Indigenous rights)
- Condition 48: Navigation and Navigation Safety Plan (effects on Indigenous rights)
- Condition 59: Worker Accommodation Strategy (GBA+)
- Condition 65: Hydrology – Notable Watercourse Crossings (climate change commitments)
- Condition 71: Riparian Habitat Management Plan (effects on Indigenous rights)
- Condition 72: Pipeline EPP (effects on Indigenous rights, climate change commitments)
- Condition 74: Horizontal Directional Drilling Noise Management Plan
- Condition 92: Updates Under the *SARA* (environmental obligations)
- Condition 93: Water Well Inventory (effects on Indigenous rights)
- Condition 94: Consultation reports – protection of municipal water sources (effects on Indigenous rights)
- Condition 96: Reports on Engagement with Indigenous Groups (effects on Indigenous rights)
- Condition 97: Traditional Land Use Investigation Report (effects on Indigenous rights)
- Condition 98: Plan for Indigenous Group Participation in Construction Monitoring (effects on Indigenous rights)
- Condition 100: Heritage Resources and Sacred and Cultural Sites Plan (effects on Indigenous rights)
- Condition 110: Authorization Under Paragraph 35(2)(b) of the *Fisheries Act* and *SARA* Permits – Pipeline (environmental obligations)
- Condition 130: Groundwater Monitoring Program (effects on Indigenous rights)
- Condition 140: Post-construction GHG Assessment Report (climate change commitments)
- Condition 142: GHG Offset Plan – Project Construction (climate change commitments)
- Condition 145: Community Benefit Program Progress Report (effects of Indigenous rights)
- Condition 147: Natural Hazard Assessment (climate change commitments)

The environmental effects assessment of the Project is a collaborative effort of several qualified professionals with element-specific expertise, under the guidance of representatives of qualified experts. Table 1-1 acknowledges the contribution of these experts and professionals by environmental element.

TABLE 1-1

ENVIRONMENTAL EFFECTS ASSESSMENT TEAM

Environmental Element	Assessment Team
Physical and Meteorological Environment	Jacobs and BGC
Soil and Soil Productivity	McTavish and Jacobs
Water Quality and Quantity	Waterline and Jacobs
Fish and Fish Habitat	Jacobs and Triton
Wetland Loss or Alteration	Jacobs
Vegetation	Jacobs
Species at Risk	Jacobs
Wildlife and Wildlife Habitat	Jacobs
Heritage Resources	Stantec
Traditional Land and Resource Use (TLRU)	Jacobs
Accidents and Malfunctions	Jacobs
Effects of the Environment on the Project	Jacobs and BGC

Notes: BGC = BGC Engineering Inc.
Jacobs = Jacobs Consultancy Canada Inc.
McTavish = McTavish Resource & Management Consultants Ltd
Triton =Triton Environmental Consultants
Waterline = Waterline Resources Inc.

1.1.1 Environmental and Socio-economic Elements

The potential environmental (*i.e.*, biophysical) and socio-economic elements interacting with the Project have been identified through a review of the original ESA; consultation and engagement with Indigenous groups; experience gained during previous pipeline projects with similar conditions/potential issues; scientific studies; and the professional judgment of the assessment team.

Environmental elements potentially interacting with the Project include:

- physical elements such as the physical and meteorological environment, soil and soil productivity, water quality and quantity, air emissions, GHG emissions and the acoustic environment; and
- biological elements such as fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat, and species at risk.

Socio-economic elements potentially interacting with the Project include heritage resources, TLRU, social and cultural well-being, Human Occupancy and Resource Use (HORU) including visual aesthetics, infrastructure and services, navigation and navigation safety, employment and economy and community health.

Effects arising from potential accidents and malfunctions, and changes to the Project caused by the environment are also considered. The original ESA identified a potential interaction for each environmental element; therefore, it was determined that the proposed Reroute does not present any potential interactions with a new environmental element.

In accordance with Guide A.2.6 of the CER *Filing Manual*, no further analysis is necessary for those elements where interactions between the Project component and an environmental element are not predicted (CER 2020a).

1.1.2 Assessment Indicators and Measurement Endpoints

Beanlands and Duinker (1983) suggest that it is impossible for an impact assessment to address all potential environmental effects of a project. Therefore, it is necessary that the environmental attributes considered to be important in project decisions be identified. Environmental impact assessments should be required to identify at the beginning of the assessment an initial set of indicators (sometimes called Valued Ecosystem Components [VECs] or Valued Social Components [VSCs]) to provide a focus for subsequent study and evaluation (Beanlands and Duinker 1983).

For this assessment, an indicator is defined as a biophysical, social or economic property or variable that society considers to be important and is assessed to predict Project-related changes and focus the impact assessment on key issues. One or more indicators are selected to describe the present and predicted future condition of an element. Societal views are understood by the assessment team through published information such as management plans and engagement with regulators, the public and specifically, Indigenous groups.

The indicators for each element have been identified based on: the CER *Filing Manua*l (CER 2020a) and other regulatory guidelines; feedback from Indigenous groups and Appropriate Government Authorities; available research literature; and professional judgment of the assessment team.

One or more 'measurement endpoints' (measurable parameters) were identified in the original ESA for each indicator to allow quantitative or qualitative measurement of potential Project effects. The degree of change in these measurable parameters is used to characterize and evaluate the magnitude of Project-related effects. A selection of measurement endpoints may also be the focus of monitoring and follow-up programs, where applicable.

1.1.3 Spatial and Temporal Boundaries

The environmental and socio-economic effects assessment considers the potential effects of the Project in the context of defined spatial and temporal boundaries. These boundaries vary with the issues and environmental or socio-economic elements or interactions to be considered, and reflect:

- the construction, operations, and future decommissioning and abandonment phases of the proposed physical works and physical activities (*i.e.,* proposed Reroute);
- the natural variation of a population, or environmental or socio-economic indicator;
- the timing of sensitive life cycle phases of various biotic elements in relation to the scheduling of the proposed physical works and physical activities;
- the time required for an effect to become evident;
- the time required for a population or indicator to recover from an effect and return to a natural condition;
- the area directly affected by proposed physical works and physical activities; and
- the area in which a population or indicator functions and within which a Project effect may be experienced.

1.1.3.1 Temporal Boundaries

The time frames of the assessment of the Project include the planning, construction, operations and future decommissioning and abandonment phases. The planning phase includes environmental studies, engineering surveys and land surveys conducted in support of the Project Application and prior to construction. The construction phase for the Trans Mountain Expansion Project (TMEP or the Project) includes surveying, clearing, soil handling, grading, pipeline trenching and testing, facility assembly or expansion and reclamation.

The current schedule for the approved route for Spread 5A around the Coldwater IR (*i.e.*, KP 930 to KP 990) indicates pre-construction activities (*e.g.,* clearing, grading) will begin in Q3 2021 with an anticipated completion date in Q4 2022. The Coldwater IR is located at approximately KP 929 to KP 955. Currently, there is no construction schedule for the proposed Reroute-specific physical work. Pending regulatory approval, Trans Mountain will update the existing TMEP construction schedule to include the proposed Reroute. The operations phase commences following completion of construction and is anticipated to extend for 50 years or more. The decommissioning and abandonment phase would occur at the end of the useful life of the pipeline (50 to 70 years).

1.1.3.2 Spatial Boundaries

A corridor approach was used for Reroute planning and assessment purposes to accommodate potential route realignments, if required, prior to finalizing the Reroute. The Reroute corridor is an approximate 300 m wide band generally centred on the pipeline centreline (*i.e.*, 150 m on both sides). There are select areas where a variable corridor width of up to 400 m was required to accommodate watercourse crossings or steep slopes. The corridor approach is used to allow for some flexibility during detailed design, execution planning and construction and to avoid environmental and cultural resources, if required, prior to finalizing the Reroute Footprint.The Reroute corridor has also been applied to the Reroute to accommodate locations where field information was unavailable due to lack of access to public lands or where input from the environmental, socio-economic, geotechnical or other disciplines would be beneficial to guide final placement of the proposed pipeline centreline and Reroute Footprint. A preliminary Reroute Footprint was applied within the Reroute corridor to support the field surveys and assessment, referred to herein as the “Reroute Footprint”. It is recognized that corridor and route refinement is an iterative process that will continue throughout the review and detailed design phase of the Project as more information becomes available.

The assessment of effects was conducted in the context of one or more of the following spatial boundaries: the preliminary Reroute Footprint; Local Study Area (LSA); Regional Study Area (RSA); Provincial Area; National Area; and International Area. LSAs and RSAs were developed on an element-specific basis and, therefore, may vary between environmental elements. The preliminary Reroute Footprint assumes certain quantitative values for the area that will be directly disturbed by Project facilities and activities within the corridor, including: a 45 m-wide pipeline construction right-of-way (assumed conservative average value including permanent easement and temporary workspace); temporary access roads (assumed to use existing access, where practical); and valves (assumed to be within the construction right-of-way). The LSA includes the area where an element is most likely to be affected by Project activities, and the RSA extends beyond the LSA to include regional boundaries (e.g., municipal or county) where direct or indirect effects may be realized.

The definitions for each spatial boundary are provided in Table 1-2.

Spatial ecological boundaries were determined by the distribution, movement patterns and potential zones of interaction between an element and the Project. The ecological boundary may be limited to the Footprint (*e.g.,* proposed pipeline construction right-of-way, access roads) or extend beyond the physical boundaries of the area of the Project component since the distribution or movement of an element can be Local, Regional or Provincial, National or International in extent. In addition to the Reroute Footprint, individually established spatial boundaries are described in Table 1-2.

TABLE 1-2

SPATIAL BOUNDARIES

Element	Spatial Boundary
Physical Environment	Physical Environment LSA: 1 km band generally extending from the centreline (*i.e.,* 500 m on both sides of the centreline).
Soil and Soil Productivity	Soil and Soil Productivity LSA: 1 km band generally extending from the centreline (*i.e.*, 500 m on both sides of the centreline).
Water Quality and Quantity	Water Quality and Quantity LSA (direct disturbance): area extending 100 m upstream of the centre of centreline and a minimum of 300 m downstream of the centreline. Water Quality and Quantity LSA (groundwater): the area within 300 m of the centreline or horizontal directional drill entrance. Water Quality and Quantity LSA (downstream): determined by the zone-of-influence (ZOI), the reach where 90% of the sediment load caused by construction activities is expected to fall out of suspension. The ZOI was determined in the field based on the professional experience and judgment of the Qualified Environmental Professional in BC who considered relevant site-specific factors (*e.g.,* stream gradient, channel width, channel depth, substrate composition, channel. morphology, flow velocity and discharge and instream cover). Aquatics RSA: includes the Lower-Nicola Watershed.
Air Emissions	Air Quality RSA: 5-km-wide band generally extending from the centreline (*i.e.,* the Project Footprint plus 2.5 km on both sides of the centreline).
GHG Emissions	Beyond Regional (*i.e.*, International).
Acoustic Environment	Acoustic Environment LSA: 1.5-km-wide band extending from the Footprint. Acoustic Environment RSA: 10-km-wide band extending from the centreline (*i.e.*, 5 km on both sides of the centreline).
Fish and Fish Habitat	Fish and Fish Habitat LSA: area extending 100 m upstream of the centreline to a minimum of 300 m downstream of the centreline at defined watercourses. The Fish and Fish Habitat LSA also includes the area of riparian vegetation to a width of 30 m back from each bank edge within the width of the construction right-of-way. Aquatics RSA: includes the Lower-Nicola Watershed.
Wetland Loss and Alteration	Wetland LSA: 300-m-wide band generally from the centre of the centreline (*i.e.,* 150 m on both sides of the centreline). Wetland RSA: generally aligns with the Aquatics RSA.
Vegetation	Vegetation LSA: generally consists of a 300-m-wide band from the centreline (*i.e.*, 150 m on both sides of the centreline). Vegetation RSA: 2-km-wide band to correspond with the Wildlife LSA.
Wildlife and Wildlife Habitat	Wildlife LSA: 1 km-wide band from the centreline where there is a reasonable potential for Project-specific effects to occur. The Wildlife LSA considers the wildlife species expected to interact with the Reroute, the effects pathways, and available information on wildlife sensitivity to disturbance (e.g., ZOI, setback distances). Wildlife RSA: 15 km buffer of the centreline. The Wildlife RSA encompasses the Wildlife LSA and the broader surrounding area where there is potential for interaction with existing activities and reasonably foreseeable developments to have cumulative effects.
Heritage Resources	Heritage Resources RSA: intersecting Borden Blocks.
TLRU	TLRU LSA: ZOIs encompassing water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources. TLRU RSA: RSA boundaries encompassing water quality and quantity, air emissions, acoustic environment, fish and fish habitat, wetland loss or alteration, vegetation, wildlife and wildlife habitat and heritage resources.
Social and Cultural Well-being	Socio-economic RSA: communities within 50 km of the proposed pipeline corridor including Coldwater IR, Paul’s Basin No. 2, the City of Merritt, Lower-Nicola and Logan Lake.
HORU	HORU LSA: 2-km-wide band extending from the Project Footprint (*i.e.*, the Project Footprint plus 1 km on each side). HORU RSA: RSA boundaries encompassing fish and fish habitat, wetlands, vegetation and wildlife.
Employment and Economy	Socio-economic RSA: communities within 50 km of the proposed pipeline corridor including Coldwater IR, Paul’s Basin No. 2, the City of Merritt, Lower-Nicola and Logan Lake. Provincial Area (BC) National Area (Canada)

1.1.4 Potential Environmental and Socio-economic Effects

The potential environmental and socio-economic effects resulting from the Project were primarily identified through a review of the original ESA; consultation and engagement with Indigenous groups; experience gained during previous pipeline projects with similar conditions/potential issues; scientific studies; and the professional judgment of the assessment team.

This assessment is based on preliminary engineering and designs. In general, conservative assumptions have been used. In order to confirm the predictions on environmental effects, further technical development will be carried out in the engineering and detailed design phase.

1.1.5 Mitigation Measures

Mitigation measures, as defined under the *CEA Act, 2012*, means measures for the elimination, reduction or control of a project's adverse environmental effects, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

To ensure that the potential adverse environmental effects are reduced, general and site-specific mitigation measures are outlined in the Pipeline EPP (Filing ID C01961). Resource-specific mitigation measures are incorporated into the assessment. In addition, various Federal and Provincial regulatory authorities, and industry-accepted standards and guidelines are considered in the ESA.

Trans Mountain will prepare EASs and RSMTs prior to construction which identify where some site-specific mitigation measures are to be implemented. Trans Mountain will retain inspector(s) to help ensure that the mitigation measures within this ESA are understood and properly implemented during construction.

1.1.6 Residual Effects

As defined in the CER *Filing Manual* (CER 2020a), residual effects are the environmental and socio-economic effects that are present after mitigation measures are applied. In many situations, the mitigation measures are predicted to eliminate the potential adverse effects while in other situations, the mitigation measures are predicted to lessen the effects, but do not entirely eliminate them. Elements for which no residual effects are predicted require no further analysis (*i.e.*, significance evaluation).

1.1.7 Significance Evaluation of Potential Residual Effects

The determination of the significance of potential residual effects generally followed the guidelines and principles provided by the resources listed in subsection 1.1. The agencies identify several possible methods for determining whether residual environmental effects are significant. These include:

- the use of regulatory guidelines, environmental standards or objectives in relation to potential residual effects;
- quantitative assessment of residual effects; and
- qualitative assessment of residual effects.

The CER *Filing Manual* (CER 2020a) indicates that the quantitative method should be used where possible; otherwise, the qualitative method can be used. Some elements can be assessed quantitatively using regulatory standards and guidelines. Where there are no standards, guidelines, objectives or other established and accepted thresholds to define quantitative rating criteria or where quantitative thresholds are not appropriate, the qualitative method that is based on available literature is considered to be the appropriate method for determining the significance of most of the potential residual effects. Consequently, the significance is evaluated by developing a set of qualitative criteria based on those identified by Hegmann et al. (1999). These criteria are identified as follows and their definitions are presented in Table 1-3.

- Spatial boundary (*i.e.*, the geographic extent in the preliminary Reroute Footprint, Reroute Corridor, LSA, RSA, Provincial, National, International)
- Temporal context (*i.e.*, duration and frequency of the event causing the residual effect, reversibility of the residual effect)
- Magnitude (*i.e.*, severity of the residual effect in relation to environmental and/or regulatory standards)
- Probability or likelihood of occurrence of the residual effect
- Level of confidence or uncertainty (*i.e.*, availability of data to substantiate the assessment conclusion, previous success of mitigation measures)

TABLE 1-3

EVALUATION OF THE SIGNIFICANCE OF RESIDUAL EFFECTS - ENVIRONMENTAL ASSESSMENT CRITERIA[1]

Assessment Criteria		Definition
IMPACT BALANCE – of the Residual Effect		
Positive		Residual effect is considered to have a net benefit to the environmental or socio-economic indicator.
Neutral		Residual effect is considered to have no net benefit or loss to the environmental or socio-economic indicator.
Negative		Residual effect is considered to be a net loss or a detriment to the environmental or socio-economic indicator.
SPATIAL BOUNDARY – Location of Residual Effect		
Footprint		The area directly disturbed by surveying, construction and clean-up of the pipeline and associated physical works and activities (including, where appropriate, the permanent right-of-way, temporary construction workspace, temporary stockpile sites, temporary staging sites, access roads).
LSA		The ZOI or area where the element and associated indicators are most likely to be affected by Project construction and operations. This generally represents a buffer from the centre of the proposed pipeline corridor.
RSA		The area extending beyond the LSA boundary where the direct and indirect influence of other activities could overlap with Project-specific effects and cause cumulative effects on the environmental or socio-economic indicator. This varies for each element.
Provincial		The area extending beyond Regional or administrative boundaries but confined to BC (*e.g.,* Provincial permitting boundaries).
National		The area extending beyond BC but confined to Canada.
International		The area extending beyond Canada.
TEMPORAL CONTEXT		
Duration – (period of the event causing the effect)	Immediate	Event is limited to less than or equal to 2 days during either the construction phase or operations phase.
	Short-term	Event occurs during the construction phase or is completed within any 1 year during the operations phase.
	Long-term	Ongoing event that is initiated during the construction phase and extends beyond the first year of the operations phase or is initiated during the operations phase and extends for the life of the Project.
Frequency[2] - (how often would the event that caused the effect occur)	Accidental	Event occurs rarely over assessment period.
	Isolated	Event is confined to a specified phase of the assessment period.
	Occasional	Event occurs intermittently and sporadically over the assessment period.
	Periodic	Event occurs intermittently but repeatedly over the assessment period.
	Continuous	Event occurs continually over the assessment period.
Reversibility (period of time over which the residual effect extends)	Immediate	Residual effect is alleviated in less than or equal to 2 days.
	Short-term	Greater than 2 days and less than or equal to 1 year to reverse residual effect.
	Medium-term	Greater than 1 year and less than or equal to 10 years to reverse residual effect.
	Long-term	Greater than 10 years to reverse residual effects.
	Permanent	Residual effects are irreversible.
MAGNITUDE[3] – of the Residual Environmental Effect		
Negligible		Residual effects are not detectable from existing (baseline) conditions.
Low		Residual effects are detectable, but well within environmental and/or regulatory standards.
Medium		Residual effects are detectable and may approach but are still within the environmental and/or regulatory standards.
High		Residual effects are beyond environmental and/or regulatory standards.
MAGNITUDE[3] – of the Residual Socio-economic Effect		
Negligible		No detectable change from existing (baseline) conditions.
Low		Change is detectable but has no effect on the socio-economic environment beyond that of an inconvenience or nuisance value.
Medium		Change is detectable and results in moderate modification in the socio-economic environment.
High		Change is detectable and is large enough to result in a severe modification in the socio-economic environment.
PROBABILITY OF OCCURRENCE – Likelihood of Residual Effect		
High		Likely
Low		Unlikely

TABLE 1-3 Cont'd

Assessment Criteria	Definition
LEVEL OF CONFIDENCE[4] – Degree of Certainty Related to Significance Evaluation	
Low	Determination of significance based on incomplete understanding of cause-effect relationships and incomplete data pertinent to the Project area.
Moderate	Determination of significance based on good understanding of cause-effect relationships using data from outside the Project area or incompletely understood cause-effect relationships using data pertinent to the Project area.
High	Determination of significance based on good understanding of cause-effect relationships and data pertinent to the Project area.

Notes:

1 Significant Residual Environmental Effect: A high probability of occurrence of a permanent or long-term residual effect of high magnitude that cannot be technically or economically mitigated.

2 The assessment period for the effects assessment includes planning, construction, operations, and decommissioning and abandonment phases for the Project while the assessment period for the cumulative effects assessment includes the above interval as well as the development, construction and operations phases of activities or projects that have previously occurred and those that are planned (publicly disclosed).

3 In consideration of magnitude, there is no environmental or socio-economic standard, threshold, guideline or objective for many of the construction/operations issues under evaluation. Therefore, the determination of magnitude of the adverse residual effect often entailed a historical consideration of the assessment of magnitude made by regulators, land authorities, lessees, other stakeholders and the assessment team to adverse effects. The assessment team was also aware of the increasingly stringent societal norms related to environmental and socio-economic effects.

4 Level of confidence was affected by availability of data, precedence and degree of scientific uncertainty or other factors beyond the control of the assessment team.

For environmental elements, a significant residual effect has a high probability of occurrence, is permanent or reversible in the long-term, is of high magnitude and cannot be technically or economically mitigated.

A residual socio-economic effect is considered significant if the effect is predicted to be:

- high magnitude, high probability, short- to medium-term reversibility and Regional, Provincial or National in extent and cannot be technically or economically mitigated; or

- high magnitude, high probability, long-term or permanent reversibility, within any spatial boundary and cannot be technically or economically mitigated.

The impact balance or direction (*i.e.*, determination as to whether the effect is positive, neutral or negative) was also established for each predicted environmental and socio-economic residual effect. A positive impact balance is considered to have a net benefit to the indicator. A neutral impact balance is defined as having no net benefit or loss to the indicator. A negative balance is considered to be a net loss or detriment to the indicator.

All significance assessment criteria (*e.g.,* temporal context, magnitude) are considered by the assessment team for each residual environmental and socio-economic effect. Where appropriate, the key or most influential assessment criteria used to determine the significance of each residual effect are noted. It should be noted that the determination of a "not significant residual effect" is based on a pre-defined approach that incorporates magnitude, probability and reversibility, but a "not significant residual effect" determination does not mean that the potential residual effect is not important to one or more Indigenous groups, landowners, Appropriate Government Authorities or stakeholders.

A summary of the significance evaluation for predicted residual environmental effects arising from the construction and operations of the proposed pipeline and temporary facilities (*e.g.*, temporary access roads, staging and stockpile sites, construction offices), is provided in Table 3-2 of the ESA including residual effects arising from accidents and malfunctions.

1.2 Cumulative Effects Assessment Methodology

Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions (Hegmann et al. 1999). A cumulative effects assessment is conducted to identify how impacts from a proposed project could interact with impacts from other developments occurring in the same ecosystem or region. A cumulative effects assessment expands the scope of traditional Environmental Assessment (EA) to evaluate how multiple activities may cause cumulative effects at both the Local and Regional scales (Finley and Revel 2002). In addition, a cumulative effects assessment differs from conventional project-specific environmental effects assessments by considering larger geographic study areas, longer time frames and unrelated projects or activities (Antoniuk 2002).

Project-specific cumulative effects assessments must determine if that particular project is incrementally responsible for adversely affecting a given element (Hegmann et al. 1999). They may also assist Appropriate Government Authorities by identifying requirements for additional planning, monitoring or mitigation that are beyond the direct control of the proponent and need to be implemented or led by others. Therefore, the total cumulative effect on a given environmental or socio-economic indicator must be identified; however, the cumulative effects assessment must also make clear to what degree the project under review is contributing to that total effect.

According to the *CEA Act, 2012,* a project-specific cumulative effects assessment need only focus on Regional concerns where the principal project's activities may incrementally contribute to these concerns. Only those resources that are likely to be directly affected by the project under review, as well as other likely projects or activities, need to be included in the project-specific cumulative effects assessment.

The cumulative effects assessment evaluates the residual environmental effects directly associated with the proposed Reroute in combination with reasonably foreseeable residual effects arising from other projects and activities that have been or will be carried out in the element-specific LSA or RSA of the Project. Future projects considered in the assessment do not include proposed or hypothetical projects where formal plans have not been disclosed.

The Project cumulative effects assessment applies the following steps.

1. Identify potential residual effects of the Project.
2. Determine spatial and temporal boundaries for each environmental indicator where residual effects have been identified for the Project.
3. Identify existing activities and reasonably foreseeable developments with residual effects that may act in combination with the residual effects of the Project.
4. Identify potential cumulative effects.
5. Develop technically and economically feasible mitigation measures.
6. Determine the significance of the Project’s contribution to cumulative effects.

Each of the above steps is described as follows in the applicable methodology subsection. This cumulative effects assessment methodology has been developed primarily based on:

- the CEA Agency’s *Cumulative Effects Assessment Practitioners Guide* (Hegmann et al. 1999);
- the CEA Agency’s *Addressing Cumulative Environmental Effects under the CEA Act, 2012* (CEA Agency 2013);
- the *CEA Act, 2012*; and
- the CER *Filing Manual* (CER 2020a).

Additional guidance was also obtained from:

- FEARO's *The Authority's Guide to the CEA Act: Part II: The Practitioner's Guide* (FEARO 1994a);
- FEARO's *A Reference Guide for the CEA Act: Addressing Cumulative Environmental Effects* (FEARO 1994b); and
- FEARO's *A Reference Guide for the CEA Act: Determining Whether a Project is Likely to Cause Significant Environmental Effects* (FEARO 1994c).

1.2.1 Identify Residual Effects of the Project

Scoping of the potential residual effects to be included in the cumulative effects assessment helps focus the cumulative effects assessment on issues that are non-trivial. While Hegmann et al. (1999), Hegmann, Eccles et al. (2002), Finley and Revel (2002) and Antoniuk (2000, 2002), among others, support the idea of narrowing the scope of issues to those of Regional concern and a subset of VECs, Duinker and Greig (2006) recommend that project scale EA analyses should proceed on the assumption that all effects are cumulative. The latter statement reflects the expectations of the CER, which are that each residual environmental effect is evaluated for potential cumulative effects (Guide A.2.7 of the CER *Filing Manual* [CER 2020a]). Nevertheless, Table A-2 of the CER *Filing Manual* indicates that likely residual effects for the physical environment and GHG elements need not be subject to a cumulative effects assessment (CER 2020a). Consequently, all other likely residual environmental effects for element-specific indicators are evaluated for potential cumulative effects.

According to Guides A.2.6 and A.2.7 of the CER *Filing Manual*, if a physical, biological or socio-economic element or indicator evaluated in the environmental effects assessment had no residual effects predicted or effects were not considered likely, these elements or indicators were excluded from the cumulative effects assessment. Therefore, the cumulative effects assessment is limited to Project elements or indicators with residual effects that could act cumulatively with residual effects from other projects or activities (CER 2020a).

1.2.2 Spatial and Temporal Boundaries

1.2.2.1 Spatial Boundaries

Defining appropriate spatial boundaries for potential cumulative effects is a critical step in the cumulative effects assessment. The selection of an excessively wide or large spatial boundary can cause any project-related cumulative effects to appear negligible compared to other actions (Hegmann et al. 1999) and increases the likelihood that an impact will be erroneously judged to be of no concern because it is relatively small in comparison (Antoniuk 2000, 2002; URS Corporation 2002).

Conversely, important Regional and long-term effects may be overlooked if the spatial boundary is too small (Hegmann et al. 1999). An excessively small boundary may cause project-related cumulative effects to appear very significant compared to other activities within the study boundary, and potentially important issues outside the established boundary may be overlooked (Finley and Revel 2002). Antoniuk (2000, 2002) and URS Corporation (2002) note that the selection of a small study area prevents consideration of incremental and cumulative effects that are best evaluated over large areas. If boundaries are small, a more detailed or quantitative examination may be feasible; however, an understanding of the broad context may be sacrificed.

Spatial boundaries or zones of influence for pipeline-related effects are variable and may be based on a consideration of the Local and Regional environmental setting and any common connections or links that the pipeline project possesses with other activities or projects. As a result, different boundaries may be appropriate for different cumulative environmental effects (FEARO 1994b; Finley and Revel 2002). The spatial boundaries used in the Project cumulative effects assessment were areas where potential cumulative effects are non-trivial and have been identified. The spatial boundaries for each element as well as the rationale for the boundaries are presented in Table 1-2.

1.2.2.2 *Temporal Boundaries*

Current accepted practice for CER Applications is to use current conditions as the baseline for pipeline cumulative effects assessment (Antoniuk 2000; URS Corporation 2002). A general discussion of the historical developments and activities that have created the baseline is included as background information.

The temporal boundaries used in the cumulative effects assessment include past development (up to the construction of the Project), the construction phase of the proposed development, and the operation phase that will commence following completion of construction and extending to the expected life of the Project (*i.e.*, 50+ years).

Temporal boundaries identified for each element are outlined as follows.

- Soil and Soil Productivity: construction to operation
- Water Quality and Quantity: construction to operation
- Air Emissions: construction to operation
- Acoustic Environment: construction to operation
- Fish and Fish Habitat: construction to operation
- Wetlands: past development to operation
- Vegetation: construction to operation
- Wildlife and Wildlife Habitat: construction to operation
- TLRU: construction to operation
- Social and Cultural Well-being: construction
- HORU: construction to operation
- Infrastructure and Services: construction and operation
- Community Health: construction

1.2.2.3 *Existing Activities and Events*

Past Development

Occupation of BC by Indigenous groups has been confirmed at about 6,000 to 8,000 years ago by carbon dating. The coastal people concentrated along the lower reaches of the major salmon rivers. They were a semi-sedentary people and developed an elaborate culture distinguished by totem poles and potlatches. Interior inhabitants developed a generally nomadic hunting and fishing culture adapted to the forested mountains, dry central interior and the riverine resources of the area.

The first permanent European settlement came with the development of the fur trade in the early nineteenth century. At mid-nineteenth century, the only non-Indigenous settlements in what was to become BC were fur trade posts on the coast, such as Victoria, Nanaimo and Fort Langley, and in the interior, such as Kamloops, Fort George (later Prince George) and Fort St. James.

This relatively quiet period of history ended in 1858 following the discovery of gold along the lower and middle reaches of the Fraser River, which led to an inland supply and transportation system along the Fraser River to the Cariboo Mountains. Thousands of prospectors journeyed to the region from California and other parts of the world. Mining became important in 1858 with the Fraser Gold Rush and later discoveries in the Cariboo region. Permanent mining towns began to establish along valleys of southeast BC by the 1880s, supported by local forestry, small farms and complex rail, road and water transport. In the early 1980s, mining in the area was highlighted by large, open-pit copper mines southwest of Kamloops. In contrast, settlement was more urban and commercial on the southwest coast.

Vancouver was selected as the site for the western terminal of the Canadian Pacific Railway in 1886, and it became the main port through which both coastal and interior products moved to world markets. Construction of the Grand Trunk Pacific Railway west from Edmonton through the upper Fraser, Bulkley and Skeena valleys from 1907 to 1914 was intended to give Canada a second gateway through the mountains to the Pacific coast.

Lumber mills were established in the southwest after the middle of the nineteenth century to supply the building needs of the growing settlements and to export to nearby Pacific settlements. The pulp and paper industry remained coastal until the mid-1960s, when mills were opened in several places across the interior. This interior expansion was part of the general spread of the forest industry into the interior of the Province. Forestry was and continues to be an important economic pillar for the Province, however, the industry has experienced considerable decline over recent years.

By the mid- to late-twentieth century, thousands of Canadians migrated to BC, attracted by the mild climate and perceived economic opportunities, joining thousands of other immigrants from Asia. In the twenty-first century, BC is now one of Canada's most prosperous and fastest growing Provinces in part due to its diverse natural resource industry and, in particular, the more recent growth and development of the natural gas sector in the northeast of the Province. However, the population has always been primarily urban - in 2001, 84.7% was classified as urban, with most people residing in the southwest region (Robinson 2012).

Existing Activities and Events

The economic base of the Thompson-Nicola Regional District (TNRD) includes forestry and wood products, agriculture, tourism and government services. Prominent industries in the last decade include: retail trade; health care and social assistance; accommodation and food services; and construction (Statistics Canada 2013).

Natural disturbance commonly results from forest fires (mainly interior BC), forest pests (mainly interior BC), avalanches along the Coquihalla River valley, and flooding, particularly along the North Thompson, Thompson, Coldwater, Coquihalla and Lower Fraser Rivers.

Key incorporated population centres in the TNRD include the Village of Valemount, the District of Clearwater, the City of Kamloops, the City of Merritt and the District of Barriere, as well as many small, unincorporated communities such as Blue River, Vavenby, Avola and Little Fort.

The Agricultural Land Reserve in the TNRD accounts for less than 13% of the overall area of the Regional district. The dominant types of agricultural activity in TNRD are classified as unmanaged pasture and managed pasture at 79% and 10%, respectively. Crops, mainly alfalfa and other fodder crops, account for 7% (BC Ministry of Agriculture and Lands 2008).

Outdoor recreational activities within various RSAs include snowmobiling, heli-skiing, cross-country skiing, all-terrain vehicle use, mountain biking, hiking, horseback riding, camping, golfing, rafting, kayaking, canoeing and sight-seeing. Recreational boating and fishing occur on the larger watercourses (*e.g.*, the Fraser, North Thompson, Thompson, Nicola, Coldwater and Coquihalla Rivers).

Current and ongoing transportation activities in the RSA for various elements may include regular and commercial vehicle traffic, as well as maintenance activities on roads, bridges, highways, railways and airports.

Current and ongoing utility activities in the RSA for various elements include maintenance on transmission line, fibre optic line and gas distribution rights-of-way. Other ongoing and current utility activities include operation and maintenance activities associated with public utilities and services (*e.g.*, water and sewer lines, landfills), electric substations and waste-to-energy facilities.

Ongoing mining operations in the various RSAs include aggregate quarries and metal mines. Exploration activities (*e.g.*, sample drilling) are assumed to be ongoing in various RSAs.

Reasonably Foreseeable Developments

Reasonably foreseeable developments that are likely to occur in the Project area will vary depending on the spatial boundaries identified for the specific socio-economic element.

The criteria used to determine projects that may act cumulatively with the Project are:

- certain – the physical activity will proceed or there is a high probability it will proceed (*i.e.*, the project is either under construction, has been approved or is in the process of obtaining approval); or
- reasonably foreseeable – the physical activity is expected to proceed (*i.e.*, the project proponent has publicly disclosed its intention to seek the necessary approvals to proceed).

An updated reasonably foreseeable development search was conducted in May 2020 with a focus on the spatial boundaries identified for the proposed Reroute (subsection 2.1.3.2). Sources reviewed to identify any projects/activities that could have cumulative interactions with the Project include: BC EAO 2020; BC MoTI 2020; IAA 2020; Government of Canada 2020; ECCC 2020; Province of BC 2020; IHS 2020a,b,c or on the webpages of utilities companies and government departments responsible for infrastructure (BC Hydro 2020; BC OGC 2020; City of Merritt 2020; TNRD 2020).

There are no reasonably foreseeable or existing or reasonably foreseeable facilities or well sites located within any of the spatial boundaries. The proposed Reroute crosses an existing natural gas pipeline operated by North River Midstream Energy Limited (IHS 2020a). The existing Trans Mountain Pipeline is located approximately 4.1 km away (IHS 2020a). There are no other reasonably foreseeable developments identified within the RSAs.

1.2.3 Potential Cumulative Effects

The identification of potential cumulative effects depends on many factors, including:

- the source of the disturbance;
- spatial and temporal boundaries;
- resilience of the receiving environment; and
- the way in which disturbances interact in time and space.

The level of detail provided in the analysis reflects the extent to which a cumulative effect on an environmental element is probable, the likely scale or magnitude of effect, as well as the extent to which these effects can be accurately and reasonably quantified and described relative to the receiving environment.

Many potential residual effects were assessed qualitatively due to a lack of detailed information on reasonably foreseeable developments and the routing of the proposed pipeline adjacent to the existing rights-of-way for most of its length.

The environmental effects in which adverse residual effects are predicted and are analyzed in the cumulative effects assessment are:

- physical elements such as soils and soil productivity, water quality and quantity, air emissions and acoustic environment; and
- biological elements such as fish and fish habitat, wetland loss and alteration, vegetation, wildlife and wildlife habitat and species at risk.

The potential and likely residual effects associated with the construction and operation of the proposed Reroute on each element are identified along with the identification of existing activities or reasonably foreseeable developments that could act in combination with the proposed Reroute, as well as the total cumulative effect and, if warranted, additional mitigation measures.

1.2.4 Mitigation Measures

Best management practices implemented to mitigate project-specific effects often limit the potential cumulative environmental effects (Finley and Revel 2002). The goal of mitigation is to attempt to avoid or reduce adverse effects to acceptable or non-significant levels. Mitigation measures are implemented to reduce the impact of any residual effects which may occur including reducing the magnitude of the effect, limiting the extent of the effect and shortening the reversibility of the effect (*i.e.*, time to alleviate the residual effect).

In all cases, mitigation measures implemented for the Project will reflect current conditions and sensitivities specified in the EPPs and on the Resource-Specific Mitigation Tables (RSMTs) and on the EAS that will be submitted prior to construction. Implementation of these mitigation and offset (compensation) measures will reduce the severity of cumulative effects arising from the Project in combination with other reasonably foreseeable developments.

1.2.5 Determination of Significance

The overall cumulative effects on an element is described for each applicable element or indicator.

An evaluation of significance conclusions for total cumulative effects (TCE) (existing activities plus reasonably foreseeable Project developments) as conducted. It was assumed that all effects would contribute to TCE. Project contribution was assumed to overlap in time and space with existing and reasonably foreseeable riparian disturbance in the CEA assessment area.

In general, environmental and/or regulatory standards for TCE were assumed to be exceeded where: a potentially affected species or member of an indicator group was categorized as Endangered or Threatened under the *SARA*; specific regulatory guidance (*e.g.*, air, water, or sediment quality objectives has been or is considered likely to be exceeded); a regulatory no net loss objective exists; or where an exceedance to a threshold or regulatory guidance has or is likely to occur for individual populations, subpopulations, ranges or landscapes where more detailed information was available. In the absence of specific information on individual populations, subpopulations, ranges or landscapes, a regulatory standard was assumed to be exceeded where a species or member of an indicator group was categorized Endangered or Threatened under the *SARA*. The rationale was that these species have been listed likely due to past landscape development which has resulted in long-term or permanent loss or alteration of suitable habitat sufficient to affect population viability.

Significance ranges applied to TCE socio-economic indicators generally reflected community size, with the assumption that smaller communities would have a lower capacity to absorb workers and development activities than urban centres.

The significance of the Project's contribution to cumulative effects is determined in a manner similar to that used to determine the significance of Project-related residual effects as previously outlined in subsection 2.1.7. All significance assessment criteria (*e.g.*, temporal context, magnitude) applies to cumulative effects and are considered by the assessment team for each cumulative environmental effect.

2.0 REFERENCES

Antoniuk, T. 2000. *Cumulative Effects Assessment of Pipeline Projects*. pp. 143-161 in Cumulative Environmental Effects Management Tools and Approaches, Alan J. Kennedy (Ed). Papers from a symposium held by the Alberta Society of Professional Biologists. Calgary, AB.

Antoniuk, T. 2002. *Cumulative Effects Assessment and Linear Corridors: The Representative Areas Approach*. pp. 209-218 in Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. J.W. Goodrich-Mahoney, D.F. Mutrie and C.A. Guild (Eds.). Elsevier Science Ltd.

Beanlands, G.E and P.N. Duinker. 1983. A*n Ecological Framework for Environmental Impact Assessment in Canada*. Institute for Resource and Environmental Studies, Halifax.

British Columbia Environmental Assessment Office (BC EAO). 2020. EPIC. Accessed February 2020. https://www.projects.eao.gov.bc.ca/.

BC Hydro. 2020. Projects. Accessed February 2020. https://www.bchydro.com/energy-in-bc/projects.html.

British Columbia Ministry of Agriculture and Lands. 2008. *Thompson-Nicola Regional District Agricultural Overview*. July 2008. Accessed June 2013. https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-regions/thompson-nicola .

British Columbia Ministry of Transportation and Infrastructure (BC MoTI). 2020. *Transportation and Infrastructure Projects*. Accessed February 2020. https://www2.gov.bc.ca/gov/content/transportation/transportation-infrastructure/projects.

British Columbia Oil and Gas Commission (BC OGC). 2020. *Major Projects Webmap*. Accessed February 2020. https://www.bcogc.ca/public-zone/major-projects-centre/major-projects-webmap.

Canadian Environmental Assessment Agency (CEA Agency). 2003. *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners*. 44 pp. Accessed May 2020. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/incorporating-climate-change-considerations-environmental-assessment-general-guidance-practitioners.html.

Canadian Environmental Assessment Agency (CEA Agency). 2013. *Operational Policy Statement Addressing Cumulative Environmental Effects Under the Canadian Environmental Assessment Act, 2012*. Accessed May 2020. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/incorporating-climate-change-considerations-environmental-assessment-general-guidance-practitioners.html.

Canada Energy Regulator (CER). 2020a. *Filing Manual*. Inclusive of Release 2020-02 (August 2020). Accessed August 2020. https://www.cer-rec.gc.ca/bts/ctrg/gnnb/flngmnl/index-eng.html.

Canada Energy Regulator (CER). 2020b. *Early Engagement Guide*. Accessed August 2020. https://www.cer-rec.gc.ca/bts/ctrg/gnnb/rlnggmntgd/index-eng.html.

Federal Environmental Assessment Review Office (FEARO). 1994a. *The Responsible Authority's Guide to the Canadian Environmental Assessment Act. Part II: The Practitioner's Guide*. November 1994. Hull, QC. 23 pp.

Federal Environmental Assessment Review Office (FEARO). 1994b. *A Reference Guide for the Canadian Environmental Assessment Act: Addressing Cumulative Environmental Effects.* Prepared by the Federal Environmental Assessment and Review Office. Hull, QC. 23 pp. Accessed May 2020. https://iaac-aeic.gc.ca/default.asp?lang=En&n=9742C481-1&offset=&toc=hide.

Federal Environmental Assessment Review Office (FEARO). 1994c. *A Reference Guide for the Canadian Environmental Assessment Act: Determining Whether a Project is Likely to Cause Significant Environmental Effects*. Prepared by the Federal Environmental Assessment and Review Office. Hull, QC. 23 pp. Accessed Month Year. https://iaac-aeic.gc.ca/default.asp?lang=En&n=D213D286-1.

City of Merritt. 2020. *Planning Services Overview*. Accessed February 2020. https://www.merritt.ca/development-services/#planning.

Environment and Climate Change Canada (ECCC). 2020. *EcoAction Community Funding Program – Map of Funded Projects*. Accessed February 2020. http://environmental-maps.canada.ca/ecoaction/App/index?GOCTemplateCulture=en-CA.

Finley, C.G. and R.D. Revel. 2002. *Pipeline Projects and Cumulative Effects Assessment Issues*. pp. 219-231 in Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. J.W. Goodrich-Mahoney, D.F. Mutrie and C.A. Guild (Eds.). Elsevier Science Ltd.

Government of Canada. 2020. *Major Projects Management Office*. Accessed February 2020. https://mpmo.gc.ca/project-inventory/311.

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling, and D. Stalker. 1999. *Cumulative Effects Assessment Practitioners Guide.* Prepared by AXYS Environmental Consulting Ltd. and the CEA Working Group for the Canadian Environmental Assessment Agency. Hull, Quebec.

Hegmann, G., R. Eccles and K. Strom. 2002. *Practical Approach to Assessing Cumulative Effects for Pipelines*. pp. 245-253 in Environmental Concerns in Rights-of-Way Management: Seventh International Symposium. J.W. Goodrich-Mahoney, D.F. Mutrie and C.A. Guild (Eds.). Elsevier Science Ltd.

IHS Inc. 2020a. IHS Enhanced Pipeline Data (digital file). Calgary, AB. Acquired March 6, 2020. Update Interval Monthly. Received via FTP at https://ftga.ihs.com/webclient/WebClient.jsf. Visit http://www.ihs.com for more info.

IHS Inc. 2020b. IHS Facility Data (digital file). Calgary, AB. Acquired March 6, 2020. Update Interval Monthly. Received via FTP at https://ftga.ihs.com/webclient/WebClient.jsf. Visit http://www.ihs.com for more info.

IHS Inc. 2020c. IHS Wells - Surface Hole (digital file). Calgary, AB. Acquired March 6, 2020. Update Interval Monthly. Received via FTP at https://ftga.ihs.com/webclient/WebClient.jsf. Visit http://www.ihs.com for more info.

Impact Assessment Agency (IAA) of Canada. 2020. *Canadian Impact Assessment Registry*. Accessed February 2020. https://iaac-aeic.gc.ca/050/evaluations?culture=en-CA.

Province of British Columbia (BC). 2020. *BC Major Projects Inventory* as of June 30, 2019. Accessed February 2020. https://www2.gov.bc.ca/gov/content/employment-business/economic-development/industry/bc-major-projects-inventory.

Robinson, J.L. 2012. *British Columbia History. The Canadian Encyclopedia. Historic Foundation of Canada*. Accessed June 2013. https://thecanadianencyclopedia.ca/index.php/en/article/british-columbia-and-confederation.

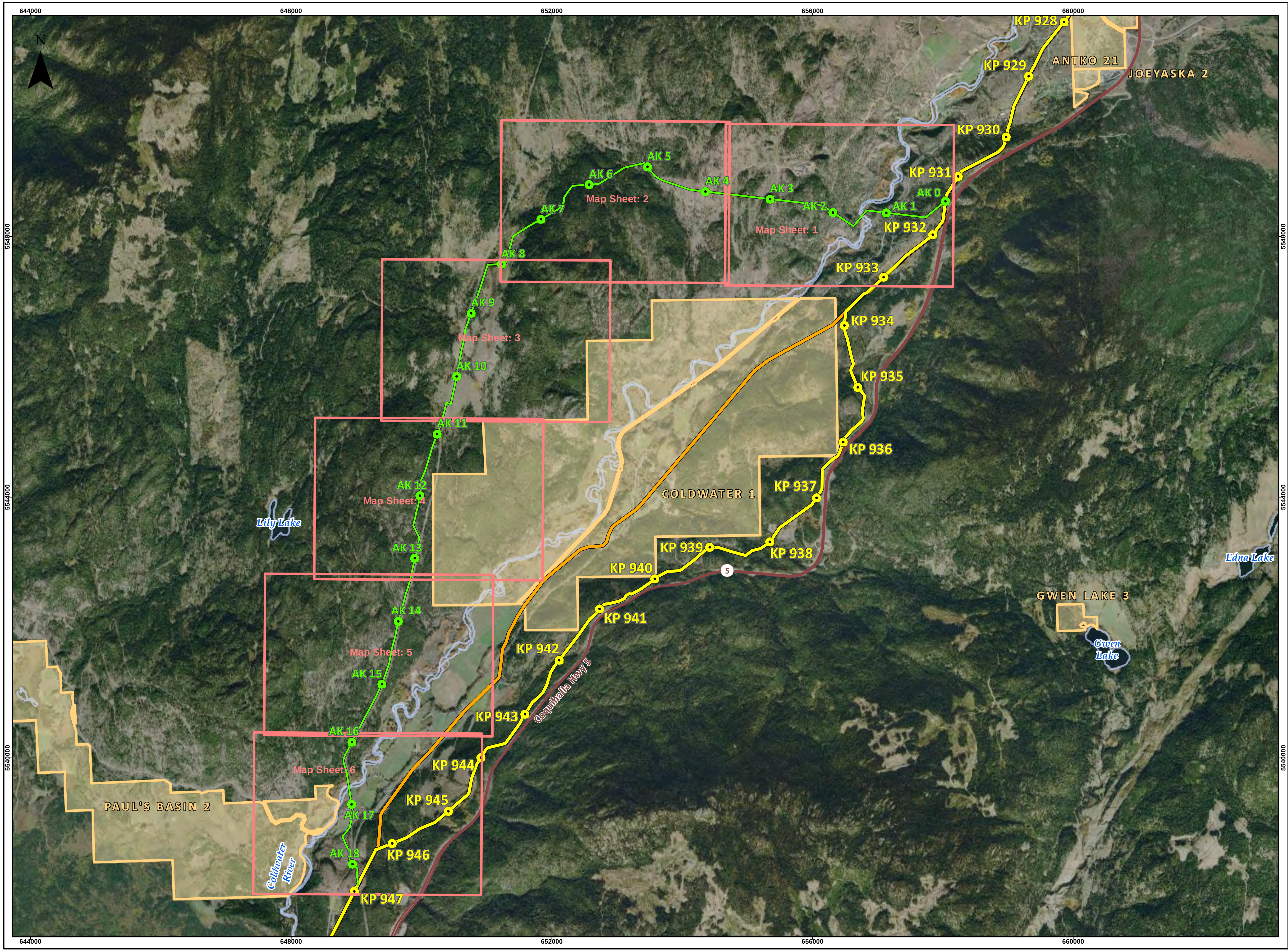
Statistics Canada. 2013. *National Household Survey Profile*. 2011 National Household Survey. Accessed August 2013. http://www12.statcan.gc.ca/nhs-enm/2011/dp-pd/prof/index.cfm?Lang=E.

Thompson-Nicola Regional District (TNRD). 2020. *Planning & Development*. Accessed February 2020. https://www.tnrd.ca/planning-development/.

URS Corporation. 2002. *Topical Report: Cumulative Effects Assessment for Gas Pipeline Projects*. Prepared for GRI, Des Plaines, Illinois. GRI Report No. GRI-02-0104.

APPENDIX G

ENVIRONMENTAL RESOURCE MAPS



TRANS MOUNTAIN

FIGURE 1

OVERVIEW OF THE COLDWATER WEST ALTERNATIVE REROUTE

ENVIRONMENTAL RESOURCE MAP

PROPOSED TRANS MOUNTAIN PIPELINE ULC

● Coldwater Reroute Kilometre Post (AK)

● TMEP Pipeline Kilometre Post (KP)

— Coldwater Reroute

— TMEP Pipeline

— Existing TMPL Pipeline

(1) Highway

▭ Indian Reserve

▭ Hydrology

▭ ERM Map Sheets

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0 provided by UPI September 08, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI, December 10, 2018; TMPL Route Revision 0 provided by TMC, May 2012; Transportation: BC MFLNRO 2015; Hydrology: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Trans Mountain Corporation (TMC) for use by the intended recipient only. This information is confidential and proprietary to TMC and is not to be provided to any other recipient without the written consent of TMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around TMC's pipelines and facilities, all of which require TMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

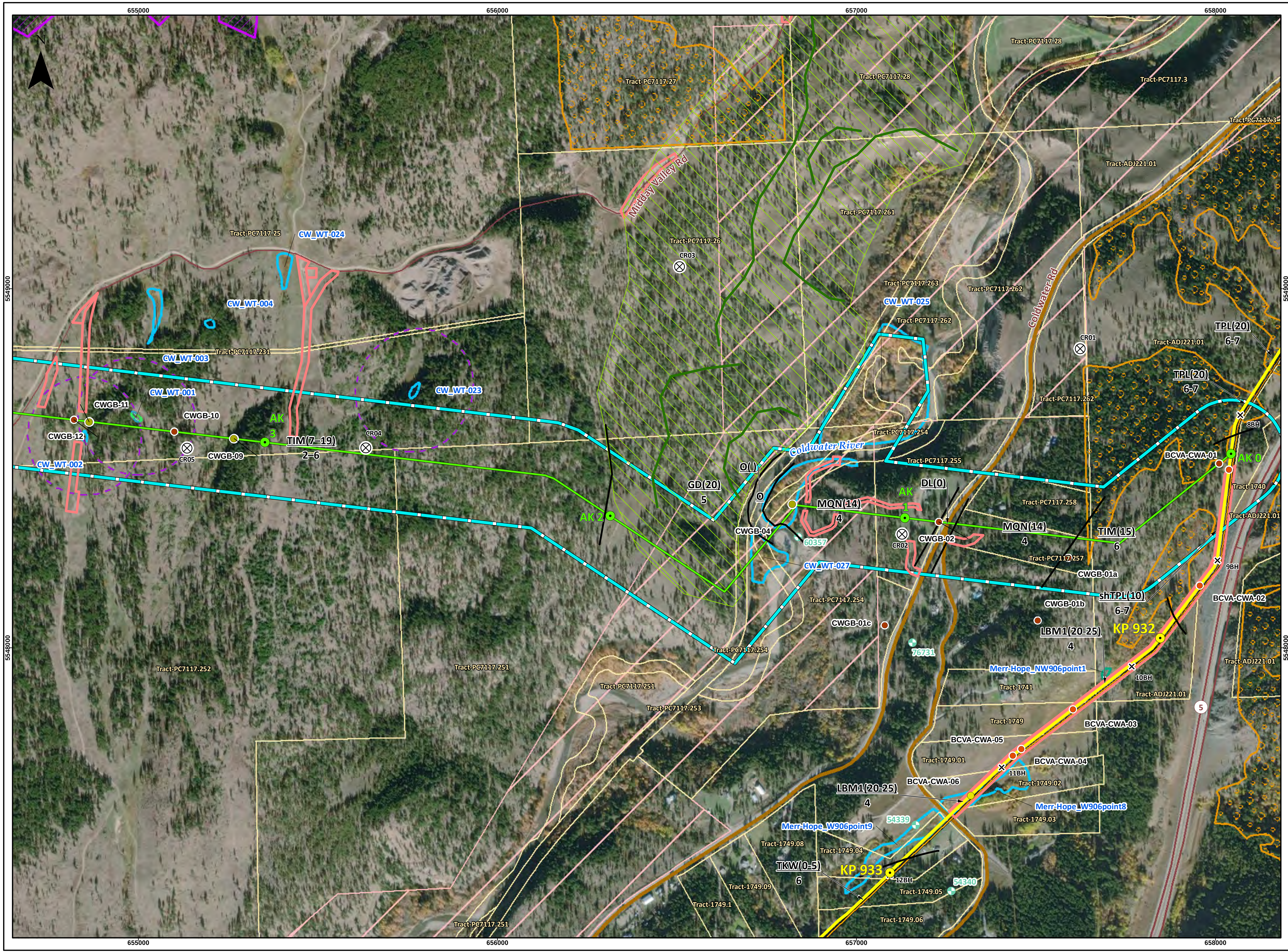
MAP NUMBER
202008_MAP_CH2M_GEN_01192_REV2_FIG1

DATE	REFERENCE	REVISION
September 2020	CE771600	2
SCALE	PAGE SIZE	DISCIPLINE
1:55,000	11x17	GEN
DRAWN	CHECKED	DESIGN
SAB	DJN	CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01192_Rev2_Fig1.mxd



TRANS MOUNTAIN

FIGURE 2

ENVIRONMENTAL RESOURCE MAP

SHEET 1 OF 6

TRANS MOUNTAIN EXPANSION PROJECT

COLDWATER WEST ALTERNATIVE REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● Kilometre Post (KP)

Coldwater Reroute Pipeline Watercourse Crossings
- ● Watercourse Crossing (S1-S4)
- ● Watercourse Crossing (NCD, S5,S6)
- ● NVC

Coldwater Reroute Access Road Watercourse Crossings
- ● Watercourse (NCD)
- ● NVC
- ▲ Digitized Access Control Points
- ● Water Wells
- × Soil Inspection Site
- ⊗ Soil Sample Site
- — Soil Break
- — Coldwater Reroute
- — TMEP Pipeline
- — TMPL Existing Pipeline
- — Coldwater Reroute Access Road
- — Existing Secondary Access
- — New Temporary Access
- — Highway
- — Paved Road
- – - Resource Road
- — Landslide Scarps
- ▨ Area of Slope Instability
- ▭ Coldwater Reroute Access Road
- ▭ Coldwater Reroute 300 m Corridor
- ▨ Rare Ecological Community
- ▨ Wildlife Habitat Feature
- ▭ Old Growth Management Non-Legal
- ▭ Parcels
- ▭ Agricultural Land Reserve
- ▭ Wetland
- ▨ Williamson's Sapsucker WHA
- ▭ Indian Reserve

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0: UPI September 8, 2020; Pipeline SSEID005.19 Spread 5A and KPs: UPI December 10, 2018; Coldwater Corridor, Jacobs September 8, 2020; Coldwater Reroute Access Road provided by August 7, 2020; WL Survey Sites: Jacobs 2020; Veg Survey Area of Interest: Jacobs, June 2019; Transportation: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Hydrology: BC MFLNRO 2014; Biogeoclimatic Zones: BC FLNRO 2014; Critical Habitat: Environment Canada 2019; Old Growth Management Areas: BC MFLNRO 2019; Parks and Protected Areas: NRCan 2017 & BC MFLNRO 2008; Watercourse Crossings provided by UPI July 15, 2019; Wetlands: Jacobs 2020; Land parcels provided by Opus Stewart-Weir, August 25, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

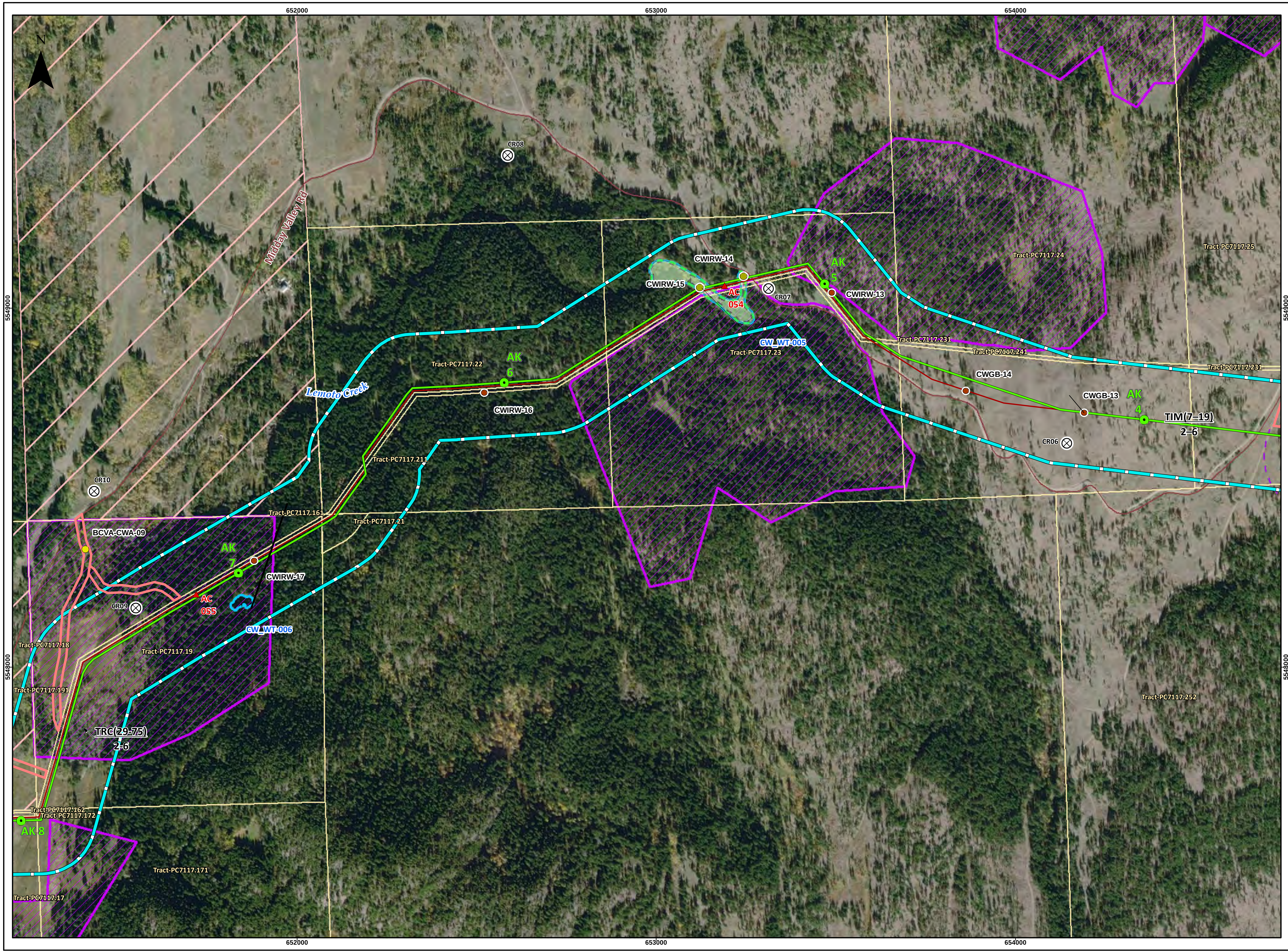
MAP NUMBER
202008_MAP_CH2M_GEN_01192_REV2_FIG2

DATE	REFERENCE	REVISION
September 2020	CE733700	2
SCALE	PAGE SIZE	DISCIPLINE
1:10,000	11x17	GEN
DRAWN	CHECKED	DESIGN
SAB	CMR	CMR

0 100 200 300 400 m

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01192_Rev2_Fig2.mxd



202008_MAP_CH2M_GEN_01192_Rev2_Fig2.mxd

TRANS MOUNTAIN

FIGURE 2

ENVIRONMENTAL RESOURCE MAP

SHEET 2 OF 6

TRANS MOUNTAIN EXPANSION PROJECT
COLDWATER WEST ALTERNATIVE REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● Kilometre Post (KP)

Coldwater Reroute Pipeline Watercourse Crossings
- ● Watercourse Crossing (S1-S4)
- ● Watercourse Crossing (NCD, S5,S6)
- ● NVC

Coldwater Reroute Access Road Watercourse Crossings
- ● Watercourse (NCD)
- ● NVC
- ▲ Digitized Access Control Points
- ● Water Wells
- × Soil Inspection Site
- ⊗ Soil Sample Site
- — Soil Break
- — Coldwater Reroute
- — TMEP Pipeline
- — TMPL Existing Pipeline
- — Coldwater Reroute Access Road
- — Existing Secondary Access
- - - New Temporary Access
- — Highway
- — Paved Road
- - - Resource Road
- — Landslide Scarps
- ▨ Area of Slope Instability
- ▭ Coldwater Reroute Access Road
- ▭ Coldwater Reroute 300 m Corridor
- ▨ Rare Ecological Community
- ▭ Wildlife Habitat Feature
- ▭ Old Growth Management Non-Legal
- ▭ Parcels
- ▭ Agricultural Land Reserve
- ▭ Wetland
- ▨ Williamson's Sapsucker WHA
- ▭ Indian Reserve

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0: UPI September 8, 2020; Pipeline SSEID005.19 Spread 5A and KPs: UPI December 10, 2018; Coldwater Corridor, Jacobs September 8, 2020; Coldwater Reroute Access Road provided by August 7, 2020; WL Survey Sites: Jacobs 2020; Veg Survey Area of Interest: Jacobs, June 2019; Transportation: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Hydrology: BC MFLNRO 2014; Biogeoclimatic Zones: BC FLNRO 2014; Critical Habitat: Environment Canada 2019; Old Growth Management Areas: BC MFLNRO 2019; Parks and Protected Areas: NRCan 2017 & BC MFLNRO 2008; Watercourse Crossings provided by UPI July 15, 2019; Wetlands: Jacobs 2020; Land parcels provided by Opus Stewart-Weir, August 25, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

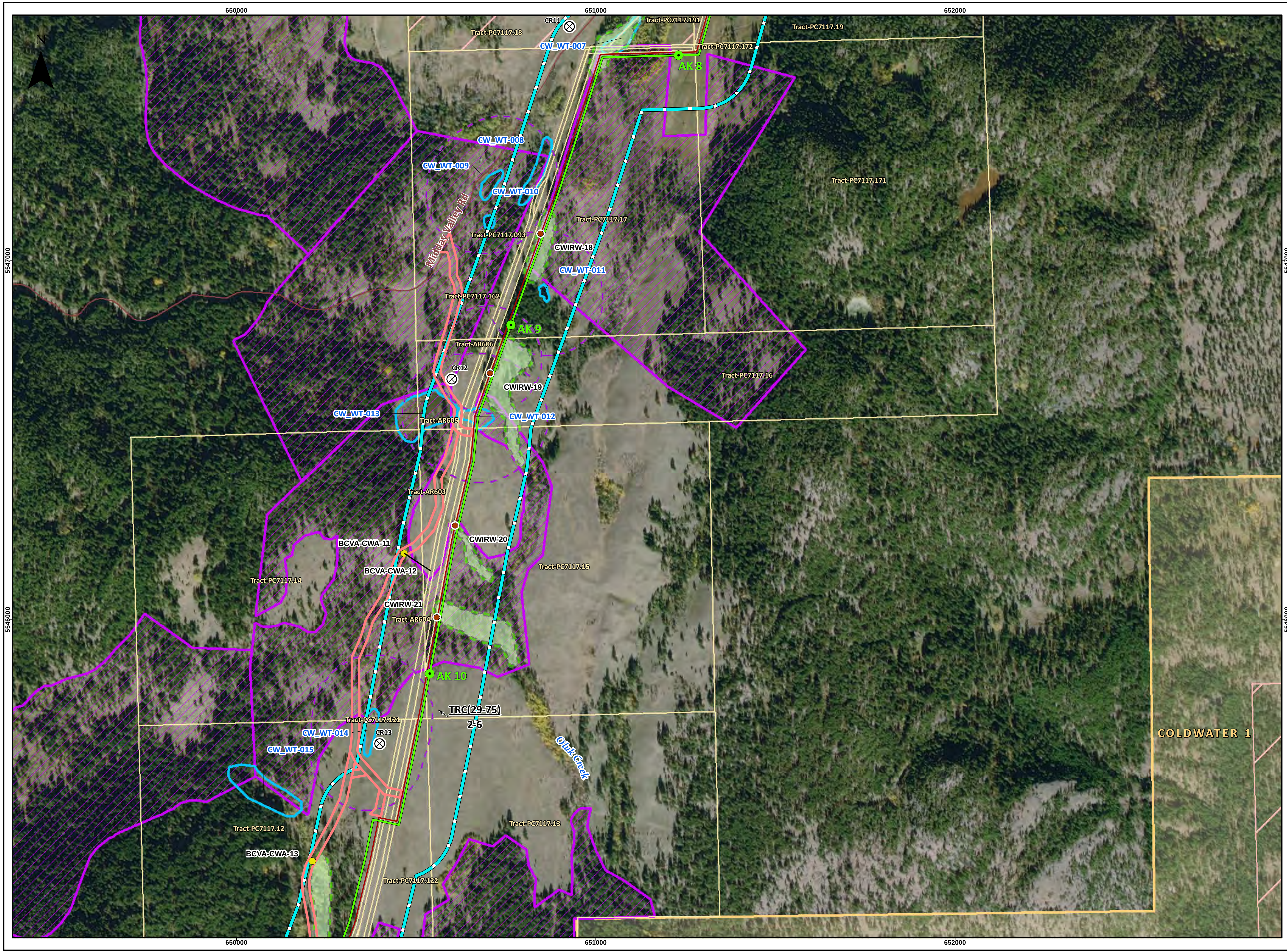
This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 202008_MAP_CH2M_GEN_01192_REV2_FIG2		
DATE September 2020	REFERENCE CE733700	REVISION 2
SCALE 1:10,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SAB	CHECKED CMR	DESIGN CMR

0 100 200 300 400 m

ALL LOCATIONS APPROXIMATE



TRANS MOUNTAIN

FIGURE 2

ENVIRONMENTAL RESOURCE MAP

SHEET 3 OF 6

TRANS MOUNTAIN EXPANSION PROJECT

COLDWATER WEST ALTERNATIVE REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● Kilometre Post (KP)

Coldwater Reroute Pipeline Watercourse Crossings

- ● Watercourse Crossing (S1-S4)
- ● Watercourse Crossing (NCD, S5,S6)
- ● NVC

Coldwater Reroute Access Road Watercourse Crossings

- ● Watercourse (NCD)
- ● NVC
- ▲ Digitized Access Control Points
- ● Water Wells
- × Soil Inspection Site
- ⊗ Soil Sample Site
- — Soil Break
- — Coldwater Reroute
- — TMEP Pipeline
- — TMPL Existing Pipeline
- — Coldwater Reroute Access Road
- — Existing Secondary Access
- — New Temporary Access
- — Highway
- — Paved Road
- - - Resource Road
- — Landslide Scarps
- ▨ Area of Slope Instability
- ▭ Coldwater Reroute Access Road
- ▭ Coldwater Reroute 300 m Corridor
- ▨ Rare Ecological Community
- ▭ Wildlife Habitat Feature
- ▭ Old Growth Management Non-Legal
- ▭ Parcels
- ▭ Agricultural Land Reserve
- ▭ Wetland
- ▨ Williamson's Sapsucker WHA
- ▭ Indian Reserve

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0: UPI September 8, 2020; Pipeline SSEID005.19 Spread 5A and KPs: UPI December 10, 2018; Coldwater Corridor, Jacobs September 8, 2020; Coldwater Reroute Access Road provided by August 7, 2020; WL Survey Sites: Jacobs 2020; Veg Survey Area of Interest: Jacobs, June 2019; Transportation: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Hydrology: BC MFLNRO 2014; Biogeoclimatic Zones: BC FLNRO 2014; Critical Habitat: Environment Canada 2019; Old Growth Management Areas: BC MFLNRO 2019; Parks and Protected Areas: NRCan 2017 & BC MFLNRO 2008; Watercourse Crossings provided by UPI July 15, 2019; Wetlands: Jacobs 2020; Land parcels provided by Opus Stewart-Weir, August 25, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

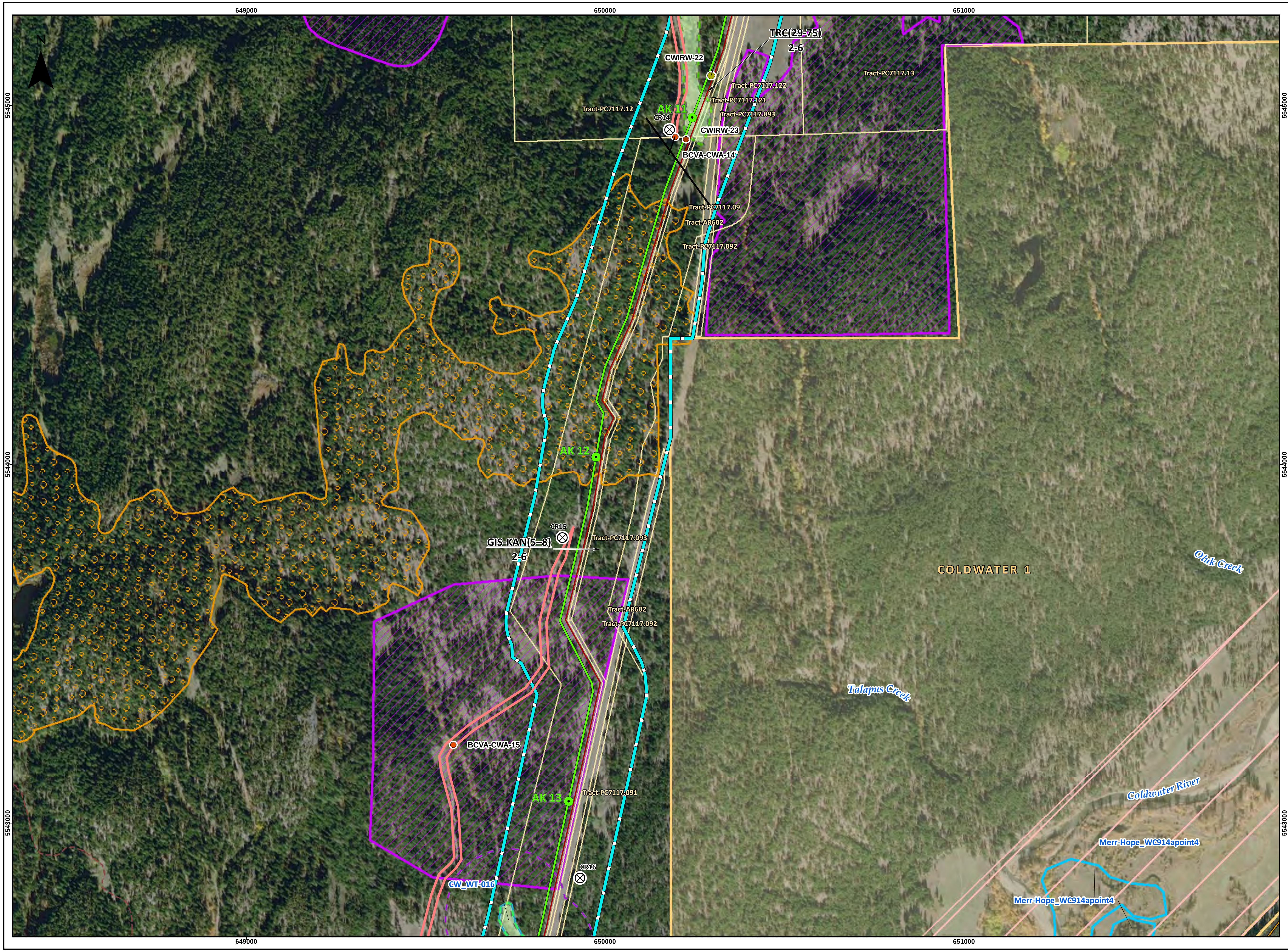
MAP NUMBER
202008_MAP_CH2M_GEN_01192_REV2_FIG2

DATE	REFERENCE	REVISION
September 2020	CE733700	2
SCALE	PAGE SIZE	DISCIPLINE
1:10,000	11x17	GEN
DRAWN	CHECKED	DESIGN
SAB	CMR	CMR

0 100 200 300 400 m

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01192_Rev2_Fig2.mxd



TRANS MOUNTAIN

FIGURE 2

ENVIRONMENTAL RESOURCE MAP

SHEET 4 OF 6

TRANS MOUNTAIN EXPANSION PROJECT
COLDWATER WEST ALTERNATIVE
REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● Kilometre Post (KP)

Coldwater Reroute Pipeline Watercourse Crossings

- ● Watercourse Crossing (S1-S4)
- ● Watercourse Crossing (NCD, S5,S6)
- ● NVC

Coldwater Reroute Access Road Watercourse Crossings

- ● Watercourse (NCD)
- ● NVC
- ▲ Digitized Access Control Points
- ● Water Wells
- × Soil Inspection Site
- ⊗ Soil Sample Site
- — Soil Break
- — Coldwater Reroute
- — TMEP Pipeline
- — TMPL Existing Pipeline
- — Coldwater Reroute Access Road
- — Existing Secondary Access
- — New Temporary Access
- — Highway
- — Paved Road
- - - Resource Road
- — Landslide Scarps
- ▨ Area of Slope Instability
- ▭ Coldwater Reroute Access Road
- ▭ Coldwater Reroute 300 m Corridor
- ▨ Rare Ecological Community
- ▨ Wildlife Habitat Feature
- ▨ Old Growth Management Non-Legal
- ▭ Parcels
- ▭ Agricultural Land Reserve
- ▭ Wetland
- ▨ Williamson's Sapsucker WHA
- ▭ Indian Reserve

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0: UPI September 8, 2020; Pipeline SSEID005.19 Spread 5A and KPs: UPI December 10, 2018; Coldwater Corridor, Jacobs September 8, 2020; Coldwater Reroute Access Road provided by August 7, 2020; WL Survey Sites: Jacobs 2020; Veg Survey Area of Interest: Jacobs, June 2019; Transportation: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Hydrology: BC MFLNRO 2014; Biogeoclimatic Zones: BC FLNRO 2014; Critical Habitat: Environment Canada 2019; Old Growth Management Areas: BC MFLNRO 2019; Parks and Protected Areas: NRCan 2017 & BC MFLNRO 2008; Watercourse Crossings provided by UPI July 15, 2019; Wetlands: Jacobs 2020; Land parcels provided by Opus Stewart-Weir, August 25, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

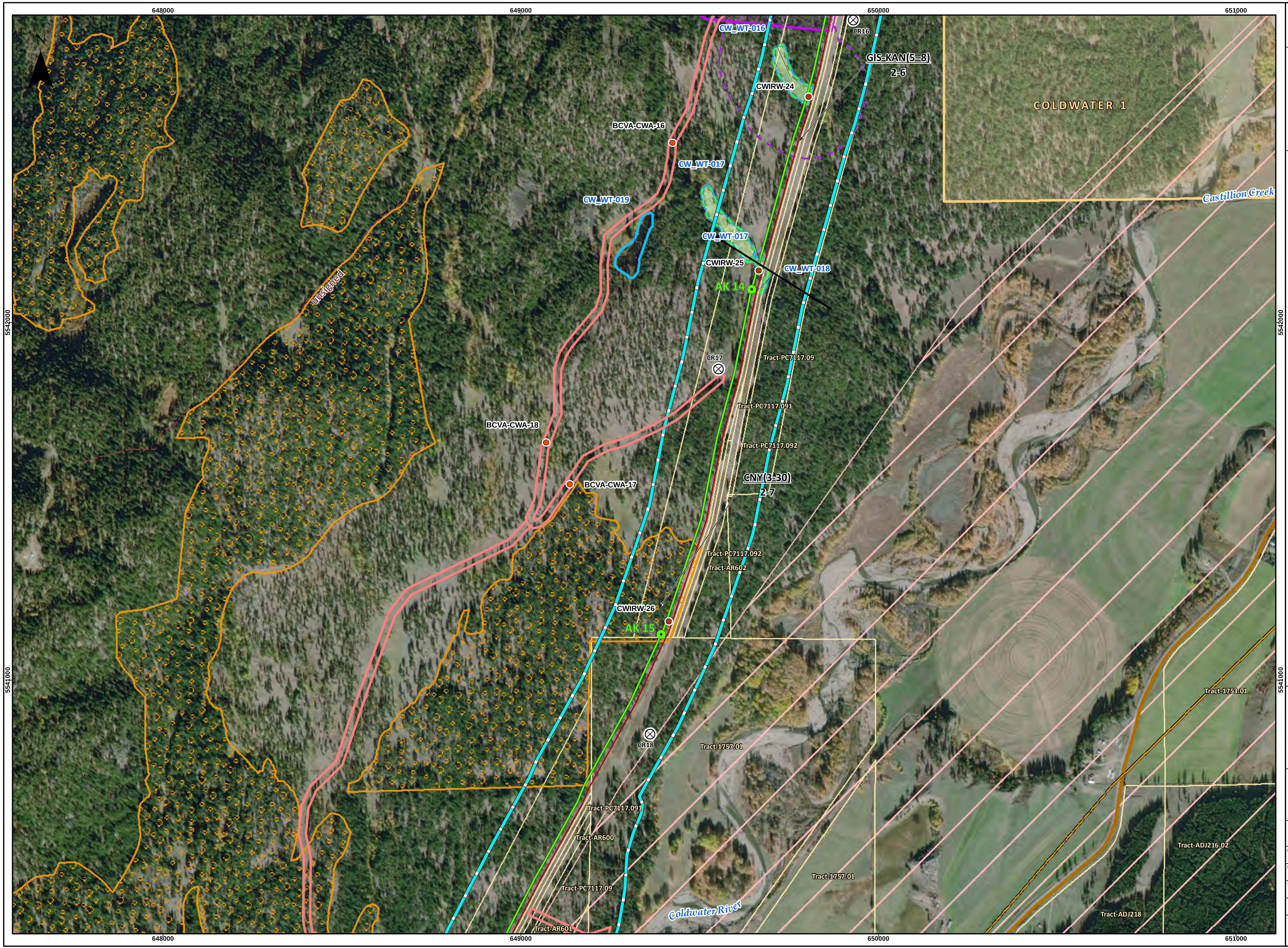
MAP NUMBER
202008_MAP_CH2M_GEN_01192_REV2_FIG2

DATE September 2020	REFERENCE CE733700	REVISION 2
SCALE 1:10,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SAB	CHECKED CMR	DESIGN CMR

0 100 200 300 400 m

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01192_Rev2_Fig2.mxd



TRANS MOUNTAIN

FIGURE 2

ENVIRONMENTAL RESOURCE MAP

SHEET 5 OF 6

TRANS MOUNTAIN EXPANSION PROJECT

COLDWATER WEST ALTERNATIVE REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● Kilometre Post (KP)

Coldwater Reroute Pipeline Watercourse Crossings

- ● Watercourse Crossing (S1-S4)
- ● Watercourse Crossing (NCD, S5,S6)
- ● NVC

Coldwater Reroute Access Road Watercourse Crossings

- ● Watercourse (NCD)
- ● NVC
- ▲ Digitized Access Control Points
- ● Water Wells
- × Soil Inspection Site
- ⊗ Soil Sample Site
- — Soil Break
- — Coldwater Reroute
- — TMEP Pipeline
- — TMPL Existing Pipeline
- — Coldwater Reroute Access Road
- — Existing Secondary Access
- — New Temporary Access
- — Highway
- — Paved Road
- - - Resource Road
- — Landslide Scarps
- ▨ Area of Slope Instability
- ▭ Coldwater Reroute Access Road
- ▭ Coldwater Reroute 300 m Corridor
- ▨ Rare Ecological Community
- ▭ Wildlife Habitat Feature
- ▭ Old Growth Management Non-Legal
- ▭ Parcels
- ▭ Agricultural Land Reserve
- ▭ Wetland
- ▨ Williamson's Sapsucker WHA
- ▭ Indian Reserve

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0: UPI September 8, 2020; Pipeline SSEID005.19 Spread 5A and KPs: UPI December 10, 2018; Coldwater Corridor, Jacobs September 8, 2020; Coldwater Reroute Access Road provided by August 7, 2020; WL Survey Sites: Jacobs 2020; Veg Survey Area of Interest: Jacobs, June 2019; Transportation: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Hydrology: BC MFLNRO 2014; Biogeoclimatic Zones: BC FLNRO 2014; Critical Habitat: Environment Canada 2019; Old Growth Management Areas: BC MFLNRO 2019; Parks and Protected Areas: NRCan 2017 & BC MFLNRO 2008; Watercourse Crossings provided by UPI July 15, 2019; Wetlands: Jacobs 2020; Land parcels provided by Opus Stewart-Weir, August 25, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

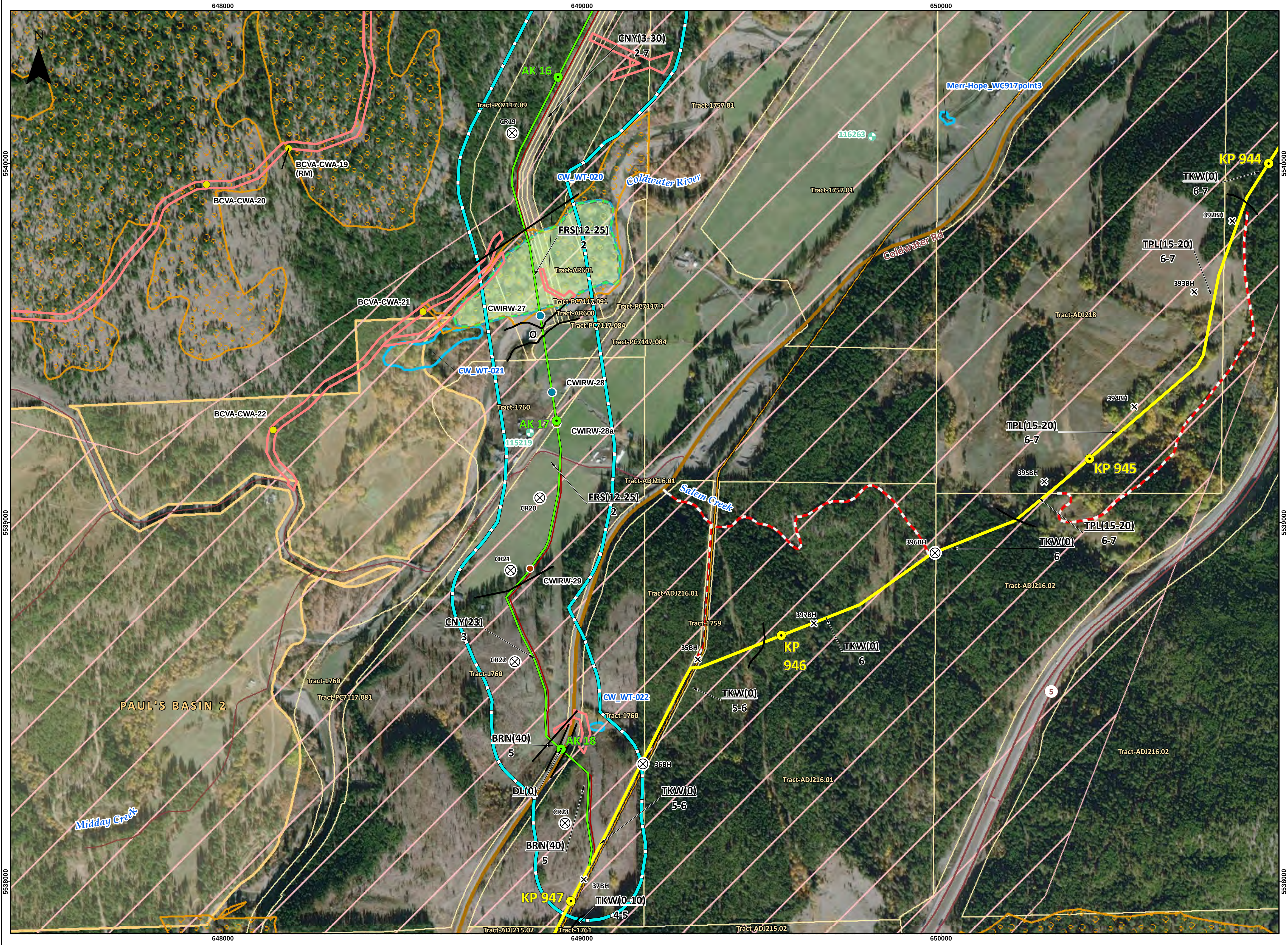
Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER 202008_MAP_CH2M_GEN_01192_REV2_FIG2		
DATE September 2020	REFERENCE CE733700	REVISION 2
SCALE 1:10,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SAB	CHECKED CMR	DESIGN CMR

0 100 200 300 400 m

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01192_Rev2_Fig2.mxd



TRANS MOUNTAIN

FIGURE 2

ENVIRONMENTAL RESOURCE MAP

SHEET 6 OF 6

TRANS MOUNTAIN EXPANSION PROJECT

COLDWATER WEST ALTERNATIVE REROUTE

- ● Coldwater Reroute Kilometre Post (AK)
- ● Kilometre Post (KP)

Coldwater Reroute Pipeline Watercourse Crossings
- ● Watercourse Crossing (S1-S4)
- ● Watercourse Crossing (NCD, S5,S6)
- ● NVC

Coldwater Reroute Access Road Watercourse Crossings
- ● Watercourse (NCD)
- ● NVC
- ▲ Digitized Access Control Points
- ● Water Wells
- × Soil Inspection Site
- ⊗ Soil Sample Site
- — Soil Break
- — Coldwater Reroute
- — TMEP Pipeline
- — TMPL Existing Pipeline
- — Coldwater Reroute Access Road
- — Existing Secondary Access
- — New Temporary Access
- — Highway
- — Paved Road
- - - Resource Road
- — Landslide Scarps
- ▨ Area of Slope Instability
- ☐ Coldwater Reroute Access Road
- ☐ Coldwater Reroute 300 m Corridor
- ▨ Rare Ecological Community
- ☐ Wildlife Habitat Feature
- ☐ Old Growth Management Non-Legal
- ☐ Parcels
- ▨ Agricultural Land Reserve
- ☐ Wetland
- ☐ Williamson's Sapsucker WHA
- ☐ Indian Reserve

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative (SSEID5.19.2), Revision 0: UPI September 8, 2020; Pipeline SSEID005.19 Spread 5A and KPs: UPI December 10, 2018; Coldwater Corridor, Jacobs September 8, 2020; Coldwater Reroute Access Road provided by August 7, 2020; WL Survey Sites: Jacobs 2020; Veg Survey Area of Interest: Jacobs, June 2019; Transportation: BC MFLNRO 2014; First Nation Lands: Government of Canada 2019; Hydrology: BC MFLNRO 2014; Biogeoclimatic Zones: BC FLNRO 2014; Critical Habitat: Environment Canada 2019; Old Growth Management Areas: BC MFLNRO 2019; Parks and Protected Areas: NRCan 2017 & BC MFLNRO 2008; Watercourse Crossings provided by UPI July 15, 2019; Wetlands: Jacobs 2020; Land parcels provided by Opus Stewart-Weir, August 25, 2020; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202008_MAP_CH2M_GEN_01192_REV2_FIG2

DATE	REFERENCE	REVISION
September 2020	CE733700	2
SCALE	PAGE SIZE	DISCIPLINE
1:10,000	11x17	GEN
DRAWN	CHECKED	DESIGN
SAB	CMR	CMR

0 100 200 300 400 m

ALL LOCATIONS APPROXIMATE

202008_MAP_CH2M_GEN_01192_Rev2_Fig2.mxd

Appendix C-1 Record of Consultation with Indigenous Groups

Ashcroft Indian Band (AIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief, Band Administrator	Email – Outgoing	Team member emailed the Chief of AIB a letter regarding consultation on a potential alternative route around The Coldwater Reserve (Coldwater Reserve) for the Trans Mountain Expansion Project (TMEP or the Project), referred to as the West Alternative Route (WAR). The letter stated that Trans Mountain (TM) was engaging with Coldwater Indian Band (CIB) on this routing option. The letter enclosed a map for reference and requested input regarding the potential route to support the ongoing feasibility study by March 20, 2020, as the study would be filed with the Canada Energy Regulator (CER) by March 31, 2020. The letter directed any questions or concerns to the TM Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Chief, Band Administrator	Email – Outgoing	Team member emailed the Chief of AIB to follow up and seek initial feedback on the WAR in the Coldwater area. Team member asked if AIB had any initial feedback or would like to set up a meeting.
April 09, 2020	Chief, Band Administrator, Legal Counsel	Email – Outgoing	Team member provided an update to the Chief of AIB on the status of the WAR feasibility study further to the referral that went out on February 28, 2020. The update stated consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that AIB advise if they wish to participate in this field program. Team member also provided a link to the current construction schedule.
April 23, 2020	Chief, Band Administrator, Legal Counsel	Email – Outgoing	Team member provided an update to the Chief of AIB stating the West Alternative Feasibility Study (WAFS) for the WAR was complete and had been submitted to CIB and the CER. Team member informed that while preliminary environmental field work is complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR, additional field work will be required and opportunities for further Indigenous participation would be available, meaning that engagement will not end at the time of filing of the WAFS Report on March 31, 2020.

April 28, 2020	Chief, Band Administrator, Legal Counsel	Email – Outgoing	Team member emailed the Chief of AIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of this geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, British Columbia (BC) using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether AIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
May 06, 2020	Chief, Band Administrator, Legal Counsel	Email – Outgoing	Team member informed the Chief of AIB of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member requested that AIB advise if they wish to participate in the field program.
May 10, 2020	Chief, Band Administrator, Legal Counsel	Email – Outgoing	Team member emailed the Chief of AIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from AIB to join as a crew member. Team member informed that it had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether AIB was interested in participating, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief, Band Administrator, Legal Counsel	Email – Outgoing	Team member emailed the Chief of AIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if AIB was interested in someone joining the crews to let TM know by May 22, 2020.

May 28, 2020	Chief, Band Administrator	Email – Outgoing	Team member emailed the Chief of AIB, and stated that on April 15, 2020, TM filed the WAFS Report with the CER which confirmed that the WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to AIB and TM would like to understand AIB's position on a potential alternative route. Further to TM's letter of February 28, 2020, TM did not receive any comments from AIB but looked forward to comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief	Email – Outgoing	Team member emailed the Chief of AIB and introduced herself as an Aquatics/Fisheries Biologist for TM's consultant, Triton Environmental (Triton). Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member stated that Triton would like to invite a representative from AIB to join Triton's field crew and explained that the crew would consist of two Triton employees plus a participant from Esh-kn-am, and potentially other participants from interested communities. Team member advised that the aquatics field program would consist of fish and fish habitat assessments at potential watercourse crossings along the proposed alternative pipeline route. The assessments would be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member stated if AIB was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
	Landmark Resource Management (LRM)		AIB's consultant, LRM, emailed Team member requesting shapefiles for the WAR and approved Project corridor in order to prepare Traditional Land Use (TLU) impact assessment maps. Team member emailed back confirming they were looking to receive shapefiles for AIB. LRM confirmed and requested a phone call to provide context around the WAR. Team member provided her contact information and availability for a phone call and sent a map of the WAR. Team member stated she would follow-up in a separate email for shapefiles.

	LRM		Team member phoned AIB's consultant, LRM, further to their request for shapefiles. LRM noted they were working with AIB and NIB on TLUS funded through the NRCan Phase 3 Terrestrial Studies Initiative. LRM and Team member discussed timelines for getting the work completed. LRM explained that it hoped the work would be complete by early 2021 for AIB. Team member explained that TM was considering a WAR in response to CIB's desire to avoid the aquifer beneath the Coldwater Reserve that is the source of drinking water in the area. Team member asked if LRM would also like the footprint of this potential route. LRM stated that they would. Team member committed to sending LRM shapefiles of the WAR.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of AIB a status update on TM's engagement on the WAR. Team member stated that TM invited comments and feedback on the WAR from AIB, provided notice of and opportunities to participate in related fieldwork and to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 06, 2020	Band Administrator	Voicemail – Outgoing	Team member left a voicemail for the Band Administrator of AIB, explaining that she would like to discuss the WAR and left her number for a return call.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of AIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website and advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Chief, Band Administrator	Email – Outgoing	Team member emailed the Chief of AIB to follow up regarding the WAR, noting that TM previously sent emails looking to understand AIB's position on the route. Team member requested confirmation that AIB had received the information, and to advise if AIB would like a presentation on the route option or had any questions.
August 12, 2020	LRM	Email – Outgoing	Team member responded to LRM's August 5, 2020 request, providing shapefiles for the WAR, and available information for facility locations including stockpile sites. Team

			member offered to answer any questions and keep in contact regarding progress and decision making on the WAR.
August 20, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of AIB in follow-up to her August 7, 2020 email and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed and stated that TM was available to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of AIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD, in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: Direct Pipe Installation (DPI) and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of AIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of AIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked AIB to confirm its interest in participating by September 30, 2020.

Boston Bar First Nation (BBFN)

Date	Community contacts	Method	Communication
March 09, 2020	Chief	Letter - Outgoing	Team member emailed a letter and a map of the WAR to the Chief of BBFN. The letter dated March 9, 2020, was regarding the potential alternative route around the Coldwater Reserve. The letter detailed background information, the feasibility study and the timeline for assessment of the WAR. The letter concluded that TM appreciated receiving any input from BBFN by March 20, 2020 and would follow up in the interim to further discuss the matter.
March 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN to follow up on the letter sent earlier that day on March 9, 2020 regarding a potential alternative route. Team member mentioned that TM was seeking initial feedback on the alternative routing in the Coldwater area. Team member inquired whether the Chief of BBFN had any initial feedback or would like to set up a meeting. Team member stated the primary goal of the WAR feasibility study was to determine whether the alternative route was technically feasible from a construction perspective and to identify any major issues with the route option.
April 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN provided an update on the status of the WAR feasibility study further to the referral that went out on February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that BBFN advise if they wish to participate in this field program. Team member also provided a link to the current construction schedule for the TMEP.
April 23, 2020	Chief	Email – Outgoing	Team member provided the Chief of BBFN an update further to the February 28, 2020 email. Team Member informed that the WAFS was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the WAFS Report on March 31, 2020.
April 28, 2020	Chief, Lands Manager	Email – Outgoing	Team member emailed the Chief of BBFN about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the

			geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using horizontal directional drilling (HDD) for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether BBFN was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
May 06, 2020	Chief	Email – Outgoing	Team member informed the Chief of BBFN of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member requested that BBFN advise if they wish to participate in the WAR field program.
May 12, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation for one representative from BBFN, if interested and available, to join as a crew member. Team member informed that both TM and its consultant, Jacobs Canada Inc. (Jacobs), had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the field work was expected to be approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and Old Growth Management Area (OGMA) studies. Team member provided an additional unlimited list of safety measures that would be applied to the scope of work. Team member requested to be advised if BBFN was interested and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if BBFN was interested in someone joining the crews to let her know by May 22, 2020.
May 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to BBFN and TM would like to understand BBFN's position on a potential Western route. Team member mentioned that TM wrote to seek BBFN's input on the WAR but had not received any

			comments. Team member stated that TM looked forward receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
May 29, 2020	Lands Manager	Email - Incoming	The Lands Manager for BBFN emailed Team member and advised that BBFN supported CIB and the concerns they might have regarding the proposed WAR. BBFN expressed they were aware that Esh-kn-am had requested to work on the field work associated with the WAR and BBFN agreed with them performing the work. BBFN clarified the comment did not abrogate the Title and Rights of BBFN and that the response did not relinquish any part of BBFN's current or future claims to Aboriginal Title and Rights.
June 01, 2020	Lands Manager	Email – Outgoing	Team member emailed Lands Manager for BBFN and acknowledged BBFN's stance. Team member asked BBFN to confirm whether they would support CIB if CIB was supportive of the WAR. Team member confirmed that Esh-kn-am would be involved in the field work.
June 01, 2020	Lands Manager	Email - Incoming	The Lands Manager for BBFN emailed Team member and confirmed that if CIB supported the WAR and their concerns had been addressed to their satisfaction, then BBFN would support CIB's decision.
June 02, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN and informed that TM's consultant, Triton, would like to invite a representative from BBFN to participate in field studies for the WAR in early July 2020. Team member advised that the field work would be three days long and consist of fish and fish habitat assessments along the proposed alternate pipeline route. Team member advised the crew would consist of two Triton employees plus a participant from Esh-kn-am and potentially other participants from interested communities. Team member requested that if the Chief of BBFN was able to find a participant to join the aquatics crew, to let her know by June 15, 2020 to allow time for planning. Team member advised that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of BBFN a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR requesting that a formal response be provided by August 15, 2020. Team member

			explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to BBFN representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up with BBFN representatives on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN to follow-up on the August 6, 2020 email. Team member offered his availability to respond to any questions on the letter and map enclosed in the earlier email.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BBFN seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.

September 15, 2020	Chief	Letter - Incoming	The Chief of BBFN emailed a letter stating BBFN’s support of Coldwater’s pursuit of the WAR.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of BBFN regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked BBFN to confirm its interest in participating by September 30, 2020.

Coldwater Indian Band (CIB)

Date	Community contacts	Method	Communication
March 02, 2020	Chief, Band Administrator, Executive Assistant	Email – Outgoing	Team member emailed a letter to the Chief of CIB, regarding consultation for the potential alternative route around the Coldwater Reserve, referred to as the WAR. The letter dated February 28, 2020 informed CIB that TM was considering the WAR for further analysis and discussion as a potential option to address CIB's concerns related to protection of the aquifer on the Coldwater Reserve. The letter requested CIB's input for the potential WAR and the placement of the new 36-inch expansion line on a route located west of the reserve. In addition to the letter, the email provided a map of the proposed alternative route. Team member requested that CIB provide their comments by March 20, 2020.
March 06, 2020	Executive Assistant	Phone call – Outgoing	Team member phoned CIB representative requesting confirmation of receipt of the consultation package and map pertaining to the potential WAR.
March 13, 2020	Chief, Council, Executive Assistant, Band Administrator	Letter - Incoming	The Chief of CIB sent a letter via email to TM. The letter dated March 13, 2020 stated that it was written in response to various communications from TM. The letter focused mainly on the hydrogeological study for the Eastern approved route and commented briefly on the WAFS and the route determination process. The letter advised that CIB did not see a path forward on the East alternative route given the alleged revocation of the commitment to complete the hydrogeological study. The letter advised that CIB wanted to schedule a meeting with TM to find a path forward regarding the hydrogeological study. The letter also advised that CIB looked forward to receiving details of the upcoming WAFS; that they were pleased that there would be consultation with other First Nations, and that CIB may request a presentation on WAFS and WAR in the future.
March 13, 2020	Chief, Council, Executive Assistant, Band Administrator <u>Other parties:</u>	Letter - Outgoing	TM emailed a letter to the Chief of CIB, NRCan, FLNRORD, and the EAO in response to previous correspondence about the hydrogeological study and the on-reserve drilling program. The letter informed that TM wished to resolve several related outstanding matters and reiterated TM's prior requests to discuss all of the items and other pressing matters such as routing, with CIB.

	Natural Resources Canada (NRCan), BC Forestry, Lands, Natural Resource Operations and Rural Development (FLNRORD), BC Environmental Assessment Office (EAO)		
March 13, 2020	Chief, Council, Executive Assistant, Band Administrator <u>Other parties:</u> NRCan, FLNRORD, EAO	Letter - Outgoing	Team member emailed a letter filed with the CER on March 13, 2020, to the Chief and Council of CIB, NRCan, FLNRORD, and the EAO. The letter provided an update on the filing of Condition 39 - Hydrogeological Study Report regarding the aquifer on the Coldwater Reserve. The letter advised that TM believed, consistent with CER's prior statements, that the process to determine completeness could run parallel to TM's three month routing negotiation timeline under Commitment #4167, such that a detailed route hearing for Coldwater Valley could proceed on or about September 2020.
March 17, 2020	Chief, Council, Executive Assistant, Band Administrator <u>Other parties:</u> NRCan, FLNRORD, EAO, Department of Justice	Letter – Outgoing	TM emailed a letter to the Chief of CIB in response to CIB's letter of March 13, 2020. The letter dated March 17, 2020, was regarding decoupling the on-reserve field program from the hydrogeological study report. Among other things, the letter reiterated TM's continued commitment to open and honest discussions with CIB regarding routing. The letter informed that TM would accept CIB's invitation to find a common path forward on routing through the Coldwater Valley and other issues of importance to CIB.
March 18, 2020	Chief, Executive Assistant, Band Administrator	Email – Outgoing	Team member emailed the Chief of CIB and followed up on the information sent on March 2, 2020 regarding request for comments by March 20, 2020 on the potential WAR. Team member provided the information again and stated that TM would appreciate any input that CIB might have by March 20, 2020. Team member advised that CIB could contact her or her colleague with any questions.

March 19, 2020	Chief, Council, Executive Assistant, Band Administrator	Email - Incoming	CIB representative emailed Team members and advised that Chief and Council were available on March 24, 2020 for a meeting via teleconference or video conference. CIB anticipated TM wanted to discuss the WAFS Update, among other topics. CIB also had the TM President and CEO's proposed meeting dates of April 2, 3 and 9, 2020 for discussion of the relationship with CIB. CIB proposed to host the meeting with zoom video conferencing, or that TM advise whether they wanted to propose another option.
March 19, 2020	Executive Assistant Other parties: EAO	Email - Incoming	Executive Assistant for CIB emailed Team members, and representative of BC Groundwater, and apologized that she had missed them on the email distribution for a meeting with Chief and Council regarding the West Feasibility Study Update and Hydrogeological Study, for March 24, 2020. CIB forwarded the noted email.
March 20, 2020	Chief, Council, Executive Assistant, Band Administrator Other parties: NRCan, FLNRORD, EAO, Department of Justice	Email – Outgoing	Team member emailed CIB representatives and thanked them for providing the email of March 19, 2020 which proposed a teleconference meeting on March 24, 2020. Team member confirmed that the TM team was available to discuss the proposed items. Team member acknowledged and suggested other agenda items of introductions, including a WAFS update and next steps. Team member informed that TM was restricted from using Zoom for the video conferencing and offered to set up the conference call using TM's toll-free number. Team member noted if that was acceptable to CIB then TM would issue an invitation to CIB and Canada.
March 23, 2020	Chief, Legal Counsel, , Executive Assistant	Email – Exchange	CIB representatives exchanged emails with Team member and thanked him for the confirmation of the conference call on March 24, 2020 with Chief and Council regarding the WAFS and other topics. CIB requested Team member to send a meeting invitation to all parties with the call-in information in a separate email to be provided to Chief and Council. CIB inquired whether TM's system had a video conferencing option and provided an agenda and requested Team member provide the TM attendees for the conference call. Team member confirmed he would set up the invitation with video conferencing. Team member advised of the TM Team members who would attend the conference call. Team member noted that Canada representatives would confirm their attendance.

March 25, 2020	Chief, Council, Executive Assistant, Band Administrator Other parties: NRCan, FLNRORD, EAO, Department of Justice	Conference call	Team member held a conference call with CIB and NRCan representatives. The conference call was regarding the WAFS and other topics.
March 31, 2020	Chief, Council, Executive Assistant, Band Administrator Other parties: NRCan, FLNRORD, EAO, Department of Justice, Indigenous Services Canada	Email – Outgoing	Team member emailed the Chief of CIB and Council and provided a copy of the WAFS for CIB's review and comment, as discussed at the meeting on March 24, 2020. Team member advised that as communicated during the meeting TM would file the report with the CER on April 15, 2020.
April 15, 2020	Chief, Council, Executive Assistant, Band Administrator Other parties: NRCan, FLNRORD, EAO, Department of Justice, Indigenous Services Canada	Email – Outgoing	Team member emailed the Chief of CIB in follow-up to TM's letter of April 3, 2020, in which TM stated its intention to file the WAFS Report with the CER on April 15. Team member shared the WAFS filing information and link and stated that TM looked forward to the discussion scheduled for April 17, 2020.
April 16, 2020	Chief, Council, Executive Assistant, Band Administrator Other parties: NRCan, FLNRORD, EAO, Department of	Letter - Incoming	Executive Assistant for CIB emailed a letter to Team member. The letter dated April 15, 2020 from the Chief of CIB provided comments on the draft WAFS Report which would be filed with the CER on April 15, 2020. The letter stated CIB's concern regarding the two-week time frame for filing of the WAFS Report, and that CIB was assured that April 15, 2020 would not be the deadline for their comments with discussion continuing after the filing. The letter stated that CIB was hoping to receive a presentation from TM on the WAFS. The letter noted that CIB's Council had not reviewed the WAFS Report, but their consulting

	Justice, Indigenous Services Canada		geoscientist had reviewed and provided comment on the geotechnical components of the study. The letter informed that CIB provided the comments on the geotechnical as well as preliminary comments on the environmental component of the study. The letter stated the comments would be filed directly with the CER, however CIB provided them to TM as draft in advance. The letter noted that should TM wish to provide comments in response to do so before end of day April 17, 2020. The letter advised that if the WAFS Report was already filed with the CER, then CIB requested that TM consider filing a new version which responded to CIB's comments and concerns. The letter addressed comments and concerns related to: - The need to ensure full information was contained in the WAFS - Species at Risk and Environmental Factors - Traditional Land Use - Risk Assessment - Relationship between the WAFS and the Coldwater Reserve Hydrogeological Study The letter concluded stating if TM was able to respond to any of the concerns before the end of April 17, 2020, that CIB would consider the response prior to submission of their comments on the WAFS with the CER.
April 16, 2020	Chief, Council, Executive Assistant, Band Administrator Other parties: NRCan, FLNRORD, EAO, Department of Justice, Indigenous Services Canada	Email – Outgoing	Team member emailed CIB representatives and confirmed receipt of the letter from the Chief of CIB with his comments on the WAFS. Team member stated that TM looked forward to meeting with CIB on April 17, 2020 for the presentation and discussion on the WAFS.
April 23, 2020	Chief, Council, Executive Assistant, Band Administrator	Teleconference	Presentation delivered to the CIB Chief and Council on the WAR.

			At the meeting, the Chief of CIB indicated that a quorum of Council was not present and that this meeting should not be deemed 'consultation'; rather information only as he needed to bring information back to Council for consideration. The Chief of CIB expressed frustration that consultation continued during COVID-19 measures; he noted this was raised directly with TM President during their last call. The COVID-19 measures pose significant challenge to communicate with membership on various activities. The Chief of CIB very much appreciated receipt of the masks as personal protective equipment was not received from government. The Chief of CIB requested follow up regarding the WAFS field studies – specifically information on timing and which Indigenous groups TMEP may invite.
April 24, 2020	Chief, Council, Band Administrator	Email – Outgoing	Team member emailed the Chief of CIB and expressed his appreciation for participation in a teleconference held April 23, 2020, and to share respective safety measures in regard to COVID-19. Team member informed CIB that TM would continue to ensure that construction and related activities were carried out in a safe manner. Team member advised further to the teleconference that TM was undertaking the drilling of two boreholes as part of the ongoing investigation on the suitability of a WAR around the Coldwater Reserve. Team member provided details regarding the geotechnical investigation for assessment of the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member advised that the work was tentatively scheduled for May 4 to 17, 2020 and welcomed questions or discussion.
April 29, 2020	Chief	In-person meeting	Team member met with the Chief of CIB on-site where Team members were performing activities related to the geotechnical WAFS, specifically two additional geotechnical boreholes (BH1&2) being completed by BGC Engineering for the HDD study. Team member advised that they were working to complete the work ahead of the upcoming study. The Chief of CIB stated it was his valley, and TM required permission to do anything within it; he stated he had not been consulted about the activity. Team member inquired if the

			Chief wanted someone to call him, and he responded that he wanted a TM Team member, or TM President and CEO, to call as soon as possible to discuss.
April 29, 2020	Chief, Council, Executive Assistant, Band Administrator, NRCan, FLNRORD, EAO, Department of Justice, Indigenous Services Canada	Letter – Outgoing	Team member emailed a letter to the Chief of CIB in response to a letter received on April 16, 2020 regarding the WAFS. The letter noted there was no practical difference between CIB providing comments on the WAFS Report prior to April 15, 2020, as opposed to a reasonable time after that date. The Feasibility Report was the starting point for discussions on routing, not the end point. The letter provided details regarding: the purpose of the WAFS Report; additional technical, environmental and archaeological work on the West Alternative; risk assessment; relationship between the WAFS Report and the Hydrogeological Study; and questions raised by CIB about the WAFS Report. The letter concluded stating that TM looked forward to continued discussions with CIB, to reach a consensus on a route through the Coldwater Valley.
May 01, 2020	Chief, Council, Band Administrator, Executive Assistant	Email – Outgoing	Team member emailed the Chief of CIB regarding several matters, including the planned borehole drilling program related to the WAR, and requested confirmation on whether CIB wished to have an observer present on site during the work. Team member advised that TM, or a representative, would also be approaching CIB and/or Esh-Kn-Am for confirmation regarding the presence of an on-site CIB archaeologist to address any potential archaeological impacts. Team member informed that the opportunity for representation regarding archaeological impacts would be offered to other First Nations as well due to the borehole site being within several traditional territories.
May 28, 2020	Chief	Phone call	Team member phoned the Chief of CIB and discussed engagement on the WAR, specifically how TM was engaging and consulting with other First Nations whose traditional territories included the proposed WAR.
May 29, 2020	Chief, Band Administrator	Email – Outgoing	Team member emailed the Chief of CIB and advised that further to their call on May 28, 2020 where he confirmed that in addition to engagement with CIB, TM was also consulting with other First Nations whose traditional territories included the proposed WAR. Team member shared that TM sought comments regarding whether or not the route may be one that First Nations could support, or if they had strong objections to the route, and their feedback would form part of the information that TM would consider in its assessment of whether or not to proceed with the route. Team member noted that some of the First Nations may also contact CIB in that regard. Team member advised of

			the First Nations that would be consulted, as per CIB's request, and that he could be contacted if there were any questions.
July 8, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CIB following up on the notification of the drilling program schedule associated with the WAR. Team member provided additional details on the borehole drillings and reiterated the option of having a CIB observer onsite, Team member asked to respond back if they would like an observer present. Team member stated understanding of both CIB and Esh-Kn-Am being actively involved in various studies regarding the WAR.
August 07, 2020	Chief, Band Administrator	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to CIB representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to the TM Indigenous Relations Advisor.
August 07, 2020	Legal Counsel	Email – Outgoing	Team member emailed CIB Legal Counsel and provided the WAR Aquatics and Vegetation Technical Data Reports for review.
August 10, 2020	Chief, Band Administrator, Executive Assistant	Email – Exchange	Team member exchanged emails with CIB representatives to arrange meeting place and itinerary for the tour of the North and South HDD crossing sites.
August 11, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB representatives to follow up regarding the WAR Technical Data Reports and the review timeline. Team Member suggested to schedule a phone call to discuss the documents and come up with a plan forward regarding the time required to review those documents. Team member requested to know some dates/times that would work best for CIB's Environmental Consultant.
August 12, 2020	Environmental Consultant, Legal Counsel	Email – Incoming	CIB's Environmental Consultant emailed Team member and informed the timeline was workable, pending confirmation from CIB Legal Counsel. Environmental Consultant advised they had received a copy of the Environmental and Socio-economic Assessment (ESA) document, and a PDF entitled "Draft ESA Figure 1" and inquired if that represented all the documents associated with the newest iteration of the ESA.

August 12, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB's Environmental Consultant confirming that the documents were from the latest Environment and Socio-Economic Assessment Draft. Team member mentioned to contact her if there were any questions/clarifications during the review of those documents.
August 12, 2020	Chief	In person site visit	Chief of CIB participated in a site visit and tour of the entry and exit staging areas for the directional drilling associated with the WAR and Coldwater River crossings.
August 13, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB's Environmental Consultant providing the draft Soils Technical Data Reports (TDR) for review and comment for the WAR. Team member informed that was the last outstanding TDR for the biophysical studies completed on the WAR. Team member requested to incorporate comments on that TDR into the Memo being prepared for August 24, 2020.
August 13, 2020	Chief, Band Administrator, Executive Assistant	Email – Outgoing	Team member emailed the Chief of CIB thanking him for the opportunity to participate in the August 12, 2020 site visit. Team member stated the tour was helpful in understanding concerns and interests including ceremonial activities in the area that may be affected by future construction. Team member stated the locations and related plans are at the "preliminary design/discussion" stage, with extensive work still being undertaken to finalize site locations. Team member said they would keep CIB informed and offered to attend a further site tour with CIB if of interest to CIB.
August 14, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB's Environmental Consultant and provided the requested Appendix E and F of the Environmental and Socio-economic Assessment.
August 18, 2020	Environmental Consultant, Legal Counsel	Email – Incoming	CIB's Environmental Consultant emailed Team member and requested copies of the 16 access road crossings referenced in the Fisheries Technical Data Report and, a shapefile of the reroute corridor to understand the footprint.
August 19, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB's Environmental Consultant and provided the requested shapefile information that was used to conduct the field assessments. Team member noted that Triton was working on the additional atlases.
August 19, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB's Environmental Consultant and provided the requested atlases for the remaining watercourses. Team member also provided the shapefile information for the access roads and noted that not all disciplines

			had completed their on-site review of the access roads, therefore it was subject to change.
August 24, 2020	Environmental Consultant	Email – Incoming	CIB’s Environmental Consultant emailed Team member and requested additional information on the Technical Data Reports for the WAR. Environmental Consultant included a table of the requested information and asked for a copy of the shapefile for the approved route.
August 25, 2020	Environmental Consultant	Email – Outgoing	Team member emailed CIB’s Environmental Consultant acknowledging the request for additional information stating she would provide the information as soon as possible. Team member attached the shapefile for the approved route.
August 25, 2020	Environmental Consultant	Email – Outgoing	Team member emailed CIB’s Environmental Consultant providing responses to the requested additional information regarding the Technical Data Reports for the WAR.
August 25, 2020	Environmental Consultant	Email – Exchange	CIB’s Environmental Consultant emailed Team member to inform that the signed letter report had been sent to CIB in care of their Legal Counsel. Environmental Consultant stated she would rely on CIB’s Legal Counsel to provide it to TM. Team member thanked Environmental Consultant for the notice regarding the Memorandum and stated she looked forward to receiving it via CIB Legal Counsel.
August 25, 2020	Legal Counsel	Email – Incoming	The Legal Counsel for CIB emailed Team member CIB’s response to the draft ESA and comments on the draft section 190 application. Legal Counsel stated there were still discussions to be had between CIB and TM and following those discussions, CIB may provide further comments. Legal Counsel referred to the approach proposed in the review memorandum stating CIB looked forward to further discussion with TM on addressing the issues identified by CIB.
September 04, 2020	Environmental Consultant, Legal Counsel	Email – Outgoing	Team member emailed CIB’s Environmental Consultant and Legal Counsel updated shapefiles for the WAR per their request on August 24, 2020. Team member summarized the following attachments: 1. The updated WAR footprint/centerline and associated access roads; 2. The Reroute corridor; 3. The alternate/contingency watercourse crossing footprint. Team member offered her availability if there were any questions or concerns.
September 08, 2020	Environmental Consultant	Phone call - Outgoing	Team member phoned CIB’s Environmental Consultant regarding the potential of alternative trenchless river crossing methods for the WAR, stating that the most recent geotechnical data for the north crossing HDD was not favorable

			and presented risks. Team member advised that the preferred crossing location would shift 500 m from the original HDD crossing location and use alternative trenchless construction methods. CIB's Environmental Consultant had no immediate concerns with this change. Team member stated that a formal notification would be sent to CIB the following day.
September 08, 2020	Chief, Band Administrator, Executive Assistant	Email - Outgoing	Team member emailed the Chief of CIB noting that TM was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is TM's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 09, 2020	Environmental Consultant, Legal Counsel	Email - Outgoing	Team member sent correspondence to CIB's Environmental Consultant regarding the formal update provided to Indigenous groups about the WAR alternative trenchless crossing methods. Team member stated the methodology and crossing location have been changed due to geotechnical issues at the original HDD crossing. Team member attached a map of the changes.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of CIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked CIB to confirm its interest in participating by September 30, 2020.

Cook’s Ferry Indian Band (CFIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB a letter on the consultation regarding a potential WAR around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB to follow up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member asked if CFIB had any initial feedback or would like to set up a meeting.
April 20, 2020	Chief	Email – Outgoing	Team member provided Chief of CFIB with an update further to the February 28, 2020 email. Team Member informed that the WAFS Report was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the feasibility study on March 31, 2020.
April 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether CFIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team

			member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
April 29, 2020	Chief	Email - Incoming	The Chief of CFIB emailed Team member and informed that CFIB was interested in monitoring the WAR borehole work. The Chief requested further details regarding requirements for the monitoring work.
April 30, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and acknowledged CFIB's interest in monitoring the borehole work. Team member noted that she had copied the colleagues who would coordinate the work. Team member requested that the Chief confirm whether Esh-kn-am would be chosen to perform the monitoring as they had worked on CFIB's behalf in the past.
May 04, 2020	Chief	Email – Incoming	The Chief of CFIB emailed Team member and confirmed that Esh-kn-am would be involved in monitoring. The Chief requested confirmation on whether TM would pay for the monitoring work. The Chief directed arrangements for the work to Esh-kn-am.
May 6, 2020	Chief, Esh-Kn-Am	Email exchange	Esh-Kn-Am representatives and Team Members exchanged emails on logistics and payment for Esh-Kn-Am to be on-site for monitoring borehole work.
May 06, 2020	Chief, Councillor	Email - Outgoing	Team member informed CFIB representatives of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member requested that the CFIB advise if they wish to participate in the field program.
May 10, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation for one representative to join as a crew member. Team member informed that both TM and its environmental consultant, Jacobs, had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to be approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether the CFIB was interested, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and provided an update of the schedule and activities related to the WAR biophysical field work occurring June 8 to July 3,

			2020. Team member noted that if CFIB was interested in someone joining the crew to advise by May 22, 2020.
May 19, 2020	Chief	Email - Incoming	The Chief of CFIB emailed Team member and inquired if the work would be funded should CFIB have an individual available to join the crew for the WAR biophysical field study.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and advised of the fieldwork process for how an individual would be funded should they join the crew for the WAR biophysical field study.
May 28, 2020	Chief, Councillor	Email – Outgoing	Team member emailed the Chief of CFIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to CFIB and TM would like to understand CFIB's position on a potential alternative route. Team member mentioned that TM wrote to seek CFIB's input on the WAR and did not receive comments. Team member stated that TM looked forward to receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and introduced herself as an Aquatics/Fisheries Biologist for Triton. Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member stated that Triton would like to invite a representative from CFIB or alternatively through Scw'exmx Tribal Council (STC) to join Triton's field crew. Team member advised that the aquatics field program would consist of fish and fish habitat assessments at potential watercourse crossings along the proposed pipeline route. The assessments would be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member stated if the Chief was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.

August 06, 2020	Chief	Letter – Outgoing	Team member emailed a status update on TM's engagement on the WAR to the Chief of CFIB. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Phone call – Outgoing	Team Member phoned the Chief of CFIB to discuss the WAR. The Chief informed that she was on days off from August 7-10, 2020 and inquired if Team member could phone on the afternoon of August 11, 2020.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a letter filed with the CER on July 29, 2020 to the Chief of CFIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team member provided a link to access a copy of the letter on the CER's website. Team member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Chief	Voicemail – Outgoing	Team member left a voicemail for the Chief of CFIB and requested a return call to understand CFIB's concerns and position as it related to the WAR routing.
August 12, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and provided the presentation on the WAR. Team member requested to know if the Chief would like a follow-up or if there were questions TM could address, as TM was interested in understanding CFIB's position on the proposed route.
August 14, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB and provided a summary of emails regarding the field work scheduled where Esh-Kn-Am supported to bring out CFIB's membership to site. Team member also provided a website link to the completed WAFS Report; a website link to a copy of the Project Notification letter; and a map of the WAR.
August 18, 2020	Chief, Councillor, Legal counsel	Virtual meeting	Team Members presented information on the WAR to Cook's Ferry representatives virtually. This included routing and environmental considerations.

August 20, 2020	Chief	Letter – Outgoing	Team member followed up with Chief of CFIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work toward consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the link to where it was filed, confirming the TM Indigenous Relations Advisor's availability to respond to any questions.
August 25, 2020	Chief, Councillor, Legal Counsel	Email – Outgoing	Team member emailed the Chief of CFIB to follow up on the request for a risk register for the approved Eastern line. Team member shared a link to this information and stated the same assessment would be completed for the WAR line. Team member shared an initial summary of the environmental impacts based on the field work of the WAR.
September 04, 2020	Chief	Email - Incoming	The Chief of CFIB emailed Team member a letter stating its support for CIB's pursuit of the WAR. The letter informed that CFIB intended to continue engaging with TM to advance the WAR.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Incoming	The Chief of CFIB emailed Team member confirming that they had received the September 9, 2020 email and attached map of the potential alternative crossing methods.

September 11, 2020	Chief	Email – Incoming	The Chief of CFIB emailed Team member requesting availability for TM to provide an online presentation and Q&A session to community members on September 19, 2020. The Chief requested the most current PowerPoint presentations on the TMEP and WAR for advance distribution to CFIB community members.
September 12, 2020	Chief	Email – Outgoing	Team member responded to the CFIB Chief's request for a community information meeting to be held via zoom on September 19, 2020 stating she would make herself available. Team member said she would provide an overview on the TMEP and the WAR and asked if this approach was acceptable.
September 13, 2020	Chief	Email – Incoming	The Chief of CFIB emailed Team member thanking her for committing to the September 19, 2020 community information meeting and confirmed the proposed meeting topics.
September 14, 2020	Chief	Email – Exchange	The Chief of CFIB emailed Team member requesting the most recent presentation of the TMEP and the WAR to provide to the community in advance of the September 19, 2020 zoom meeting. Team member emailed the Chief proposing an agenda and attached a detailed presentation of the TMEP for those unable to attend the community meeting. Team member stated she would present a shorter version with maps and answer any questions that arise.
September 15, 2020	Chief	Email – Exchange	The Chief of CFIB emailed Team member to arrange two community information meetings requested by Council for the dates of September 19 and 26 via zoom. The Chief attached a draft agenda to go out to the community with the agenda for the September 19, 2020 meeting where TM would provide a presentation of the WAR. Team member confirmed the dates and draft agenda.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of CFIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked CFIB to confirm its interest in participating by September 30, 2020.
September 23, 2020	Chief	Email – Exchange	Team member emailed the Chief of CFIB to follow up on the opportunity for CFIB to participate in an upcoming site tour for aquatics work related to the WAR. Team member asked CFIB to inform her of interest in participating prior to September 30, 2020. The Chief of CFIB responded saying she would be following up.

September 29, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB to respond to a question raised in the online community meeting on whether Esh-kn-am Cultural Resources Management Services was representing CFIB on field participation for the WAR. Team member confirmed that Esh-kn-am represented CFIB and listed the shift dates of relevance.
September 30, 2020	Chief	Email – Outgoing	Team member emailed the Chief of CFIB to provide more clarification to her previous email stating Esh-kn-am was currently in attendance for a field tour but did not have a CFIB member. Team member stated she was unaware of the process in which Esh-kn-am chooses their crew members for field participation. Team member said to inform her if a CFIB member would be required to participate in order to adequately represent CFIB.
September 30, 2020	Chief	Phone call – Incoming	The Chief of CFIB phoned Team member to state that CFIB supported CIB's pursuit of the WAR

Kanaka Bar Indian Band (KBIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of KBIB a letter on the consultation regarding a potential alternative route around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 03, 2020	Chief	Phone call - Incoming	The Chief of KBIB phoned Team member and noted he had received the referral dated February 28, 2020. The Chief expressed he was glad that TM was engaging directly with CIB and listening to their requests. The Chief noted he would defer to CIB as the most proximal community on that issue. The Chief noted he received the operations referral and would discuss it internally at the next meeting. The Chief mentioned that he still had concerns on protestors and was happy to speak to someone from TM on protesting and safety concerns.

April 09, 2020	Chief	Email – Incoming	The Chief of KBIB emailed Team member and agreed with Team member's previous status update with respect to the WAR. The Chief added he would follow up with Team member once a lands position had been filled.
April 09, 2020	Chief	Email – Outgoing	Team member provided an update to the Chief of KBIB on the status of the WAR feasibility study further to the referral that went out on February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that KBIB advise if they wish to participate in this field program.
April 21, 2020	Chief	Email – Outgoing	Team member provided an update further to the February 28, 2020 email. Team Member informed that the feasibility study for the WAR was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the feasibility study on March 31, 2020.
April 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of KBIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided details about the description of the work, key dates, and attachments. Team member requested to know whether KBIB was interested in monitoring the work. Team member noted that TM might not be able to accommodate all monitoring requests based on safety on site, and the number of Indigenous groups impacted, but could work to accommodate monitoring based on interest. Team member also provided a link regarding what TM was doing to protect communities and workers in light of COVID-19.
April 30, 2020	Chief	Email – Incoming	The Chief of KBIB emailed Team member and advised that KBIB retained a Lands Officer and noted that the TM data would be looked at from the beginning with the latest email and worked backwards to ensure that referrals were identified, separated, and responded to.
May 04, 2020	Chief, Lands Coordinator	Letter – Incoming	The Chief of KBIB emailed Team member a brief response stating she would work to review any previous notifications she had missed.

May 05, 2020	Chief, Lands Coordinator	Email – Outgoing	Team member emailed the Chief of KBIB, and advised, regarding a letter in response to the drill holes, that TM would continue to work with CIB on the issue, but also wanted to understand any impacts from the WAR by other Indigenous groups in the area. Team member advised that if KBIB would like to engage directly on any of those impacts, TM would be interested in understanding any concerns.
May 10, 2020	Chief	Email – Outgoing	Team member emailed the Chief of KBIB and advised that there was a biophysical field study scheduled for June 2020 near Merritt, BC for the WAR. Team member extended an invitation to one representative from KBIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether the KBIB was interested, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief, Lands Coordinator	Email – Outgoing	Team member emailed the Chief of KBIB and provided a schedule and list of activities related to the WAR biophysical field study occurring June 8 - July 3, 2020. Team member noted that if KBIB was interested in someone joining the crew to advise by May 22, 2020.
May 19, 2020	Lands Coordinator	Email - Incoming	The Lands Coordinator of KBIB emailed Team member and thanked her for the invitation to participate with the field crew for the WAR biophysical field study, however, KBIB respectfully declined.
May 20, 2020	Chief, Lands Coordinator	Email – Incoming	The Chief of KBIB emailed Team member and advised that KBIB would pass on having someone join the crew for the WAR biophysical field study.
May 29, 2020	Chief	Phone call - Incoming	The Chief of KBIB phoned Team member to discuss various matters. Team member inquired about KBIB's opinion on the WAR. The Chief stated KBIB would support the WAR if it was supported by CIB. KBIB noted the approach of the Nlaka'pamux Nation Tribal Council (NNTC) presented a barrier to formal support of the WAR. KBIB advised they disagreed with the approach of NNTC.
June 02, 2020	Chief	Email – Outgoing	Team member emailed the Chief of KBIB and informed that TM's consultant, Triton, would like to invite a representative from KBIB to participate in field studies for the WAR in early July 2020. Team member advised that the field work would be three

			days long and consist of fish and fish habitat assessments along the proposed alternate pipeline route. Team member advised the crew would consist of two Triton employees plus a participant from Esh-kn-am and potentially other participants from interested communities. Team member requested that if KBIB was able to find a participant to join the aquatics crew, to let her know by June 15, 2020 to allow time for planning. Team member advised that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of KBIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of KBIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team member provided a link to access a copy of the letter on the CER's website and advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up with the Chief of KBIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the link to where it was filed, confirming the TM Indigenous Relations Advisor's availability to respond to any questions.

August 20, 2020	Chief	Email – Incoming	The Chief of KBIB confirmed receipt of Team member's August 20, 2020 letter and thanked Team member.
September 01, 2020	Chief	Phone Call – Incoming	The Chief of KBIB phoned Team member and stated that he supported CIB's pursuit of the WAR and that he would review the letter that was provided.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of KBIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of KBIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of KBIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked KBIB to confirm its interest in participating by September 30, 2020.

Lower Nicola Indian Band (LNIB)

Date	Community contacts	Method	Communication
February 28, 2020	Director of Economic Development, Chief	Email – Outgoing	Team member emailed Chief and Director of Economic Development of LNIB a letter on the consultation regarding the potential WAR around The Coldwater Reserve, referred to as the WAR. Team Member stated that TM was engaging with CIB on this routing option. Team Member enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Director of Economic Development, Chief	Email – Outgoing	Team member emailed the Chief and Director of Economic Development of LNIB and followed up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member asked if LNIB had any initial feedback or would like to set up a meeting.
April 09, 2020	Director of Economic Development	Email – Outgoing	Team member provided the Director of Economic Development of LNIB an update further to the February 28, 2020 email. Team Member informed that the WAFS Report was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the WAFS Report on March 31, 2020.
April 28, 2020	Director of Economic Development	Email – Outgoing	Team member emailed the Director of Economic Development of LNIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether LNIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all

			monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM’s efforts to protect communities and workers in light of COVID-19.
April 30, 2020	Director of Economic Development, Administrative Assistant	Email – Incoming	The Director of Economic Development of LNIB responded to Team member’s April 28th email stating interest in having a monitor on the ground with the upcoming borehole drilling.
April 30, 2020	Director of Economic Development, Administrative Assistant	Email – Outgoing	Team member emailed the Director of Economic Development of LNIB and thanked them for notifying TM of LNIB's interest to have a monitor on site for the borehole work if feasible, given the restrictions due to the COVID-19 emergency. Team member copied the colleagues who were coordinating the work.
May 10, 2020	Director of Economic Development, Administrative Assistant	Email – Outgoing	Team member emailed the Director of Economic Development of LNIB and advised that there was a biophysical field study occurring in June 2020 for the WAR near Merritt, BC. Team member extended an invitation for one representative from LNIB to join as a crew member. Team member informed that the field work was expected to last approximately 2 - 3 weeks, with crews going to targeted locations to conduct wildlife, vegetation, wetlands, soils and related studies. Team member noted that they had not finalized the work program, so if LNIB had someone interested and available they could also be added to the proposed work in progress.
May 12, 2020	Director of Economic Development, Administrative Assistant	Email - Incoming	The Director of Economic Development of LNIB emailed Team member and advised that LNIB wanted a representative involved in the WAR biophysical survey field work and requested to be added to the scope of work.
May 15, 2020	Director of Economic Development, Administrative Assistant	Email - Outgoing	Team member emailed the Director of Economic Development of LNIB and advised of the information required for the field work related to the WAR biophysical study.
May 21, 2020	Referrals Technician, Administrative Assistant	Email – Outgoing	Team member emailed Referrals Technician of LNIB and confirmed that the Lewis Woodpecker biophysical field study was scheduled for July 3 - 5, 2020. Team member also advised of a schedule update for the WAR biophysical study scheduled for June 2020.

May 21, 2020	Referrals Technician, Administrative Assistant	Email – Incoming	Referrals Technician of LNIB emailed Team member and thanked her for the updated schedules regarding the Lewis Woodpecker and WAR biophysical field studies.
May 25, 2020	Referrals Technician, Administrative Assistant	Email – Outgoing	Team member emailed Referrals Technician of LNIB and advised that the soils and OGMA field work for the WAR biophysical study had been postponed and rescheduled until early July 2020.
May 27, 2020	Referrals Technician	Email – Outgoing	Team member emailed Referrals Technician of LNIB and provided the updated schedule for the Woodpecker biophysical Field Study, along with the training and safety requirements. Team member inquired if LNIB had someone to join the field crews. Team member noted that Jacobs would be sending the scope of work in the next few days.
June 01, 2020	Referrals Technician, Administrative Assistant	Email - Incoming	Referrals Technician of LNIB emailed Team member and followed up with the training and safety requirements as per email dated May 27, 2020. LNIB inquired if Team member would be sending the forms and links, as LNIB would like to have their monitor complete them for the individual to be ready for the field work.
June 01, 2020	Referrals Technician, Administrative Assistant	Email - Outgoing	Team member emailed Referrals Technician of LNIB and provided the updated training requirements and forms for review regarding the fieldwork. Team member requested that the provided quiz be completed and sent back along with a copy of the individuals driver's license. Team member noted the wildlife work was currently confirmed for June 8, 2020 which would overlap with the vegetation work starting on June 11, 2020. Team member stated that Jacobs was looking for another individual to join.
June 01, 2020	Referrals Technician, Administrative Assistant	Email – Exchange	Referrals Technician of LNIB and Team member exchanged emails regarding clarification on clearance requirements to participate in field work.
June 02, 2020	Chief	Email – Outgoing	Team member emailed Chief of LNIB and introduced herself as an Aquatics/Fisheries Biologist for Triton Environmental. Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member stated that Triton would like to invite a representative from LNIB or alternatively through STC to join Triton's field crew. Team member advised that the aquatics field program would consist of fish and fish habitat assessments at potential watercourse crossings along the proposed WAR in early July 2020. The assessments would

			be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member stated if LNIB was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
June 02, 2020	Director of Economic Development, Administrative Assistant	Email - Incoming	Director of Economic Development of LNIB emailed Team member and informed that LNIB was interested in participating in the aquatics field program. LNIB noted that they were not represented by STC. LNIB expressed they looked forward to receiving and reviewing the work terms.
June 04, 2020	Referrals Technician	Email - Outgoing	Team member emailed Referrals Technician of LNIB and inquired whether they had identified the individuals participating in the fieldwork occurring during the week of June 8, 2020.
June 04, 2020	Referrals Technician, Administrative Assistant	Email – Incoming	Referrals Technician of LNIB emailed Team member and asked whether both participants needed to have a driver's licence, and if both participants would be going to the same location and therefore be able to be in the same truck. LNIB inquired what level of truck cleaning was required beforehand.
June 04, 2020	Referrals Technician, Administrative Assistant	Email - Outgoing	Team member emailed Referrals Technician of LNIB and provided the vehicle wash form that had to be completed before arriving to site. Team member informed that the vegetation and wildlife programs would be occurring at different locations and the participants would not be able to go in the same vehicle, and due to Jacobs COVID-19 policies, they were proceeding with one person per vehicle.
June 05, 2020	Referrals Technician	Email - Incoming	Referrals Technician of LNIB emailed Team member and provided the individuals' names that would be participating in the wildlife and vegetation fieldwork during the week of June 8, 2020.
June 05, 2020	Referrals Technician, Cultural Heritage and Environmental Field Worker	Email - Outgoing	Team member emailed Referrals Technician of LNIB and informed that she would be helping to coordinate the safety and training requirements for the upcoming biophysical surveys on the Project. Team member provided the dates, orientations, safety requirements, and logistics. Team member requested to complete the TM visitor orientation and to send her a copy of the five documents and the three information requests as soon as possible.

June 10, 2020	Cultural Heritage and Environmental Field Worker	Phone call - Outgoing	Team member phoned Cultural Heritage and Environmental Field Worker of LNIB and discussed orientation planning details for biophysical fieldwork regarding the WAR.
June 10, 2020	Cultural Heritage and Environmental Field Worker	Email - Exchange	Team member exchanged email with Cultural Heritage and Environmental Field Worker of LNIB about the orientation meeting for biophysical fieldwork regarding the WAR.
June 16, 2020	Administrative Assistant	Email – Outgoing	Team member emailed Administrative Assistant of LNIB and advised the OGMA survey dates were now on July 6-7, 2020. Team member noted that due to accessibility of the OGMA sites, there would be some significant hiking of about 10+ kilometers to the sites. Team member informed the Lewis's Woodpecker survey would be located at Zoht 4, 5 and Joeyaska 2. Team member stated the Coldwater soils work would be along the same route as the wildlife and vegetation and the soil dates survey might be changing and she would update LNIB of the possible changes. Team member requested to know who would be participating in each survey.
June 18, 2020	Administrative Assistant	Email – Outgoing	Team member emailed Administrative Assistant of LNIB and informed the updated dates for the Coldwater soils fieldwork was from July 13-17, 2020.
June 19, 2020	Administrative Assistant	Email - Incoming	Administrative Assistant of LNIB emailed Team member and acknowledged the updated dates for the Coldwater soils fieldwork.
June 24, 2020	Administrative Assistant	Email – Outgoing	Team member emailed Administrative Assistant of LNIB and inquired if a participant for the Lewis's Woodpecker field work had been identified. Team member noted that Jacobs was finalizing their field planning documents and would like to add the participant's name and contact information if it was available.
June 24, 2020	Administrative Assistant, Director of Economic Development	Email – Outgoing	Team member emailed representatives of STC, LNIB and Nooaitch Indian Band, and proposed July 7 and 8, 2020 as the two field dates for the upcoming aquatics work. Team member requested to know as soon as possible if the dates worked for the field technicians/biologists. Team member reminded everyone to complete the TM orientations, as she would like to submit them to TM by June 29, 2020.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of LNIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR

			and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR requesting that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Director of Economic Development	Phone call - Outgoing	Team Member phoned Director of Economic Development of LNIB and discussed construction, WAR, engagement, and provincial permitting. LNIB confirmed that they would not state their position on the WAR until they reviewed the completed environmental studies. LNIB noted they were concerned about the short and long-term impacts of the WAR. Team member offered to provide a presentation on the WAR, and LNIB confirmed that they wished to have a presentation setup for Chief and Council.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of LNIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 07, 2020	Director of Economic Development	Email – Outgoing	Team member emailed the Director of Economic Development of LNIB and followed up on their conversation that day. Team member summarized that LNIB would not state their position on the WAR until they reviewed the completed environmental studies and that LNIB was concerned about the impacts of the WAR. Team Member asked for suggested dates for when TM could provide a presentation on the WAR to Chief and Council.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed,

			stating their Indigenous Relations Advisor's availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LNIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD considering additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LNIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of LNIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked LNIB to confirm its interest in participating by September 30, 2020.
September 23, 2020	Administrative Assistant	Email – Exchange	Team member emailed LNIB Administrative Assistant to follow up on the invitation for an LNIB representative participate in the upcoming site visit assessment. LNIB Administrative Assistant responded saying they would review and get back to Team member.

Lower Similkameen Indian Band (LSIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief, Referrals Inbox	Email – Outgoing	Team member emailed Chief of LSIB a letter on consultation regarding the potential alternative route around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Chief	Email – Outgoing	Team member emailed Chief of LSIB and followed up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member asked if LSIB had any initial feedback or would like to set up a meeting.
April 09, 2020	Chief, Referrals Inbox Other parties: Chief of UNB	Email – Outgoing	Team member provided an update to Chief of LSIB on the status of the WAR Feasibility Study stating that this referral went out on February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that the LSIB advise if they wish to participate in this field program. Team member also provided a link to the current construction schedule.
April 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LSIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether LSIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.

May 06, 2020	Chief, Referrals Inbox	Email – Outgoing	Team member informed Chief of LSIB of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member requested that LSIB advise if they wish to participate in the field program.
May 10, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LSIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from LSIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether LSIB was interested and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed Chief of LSIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if LSIB was interested in someone joining the crews to let her know by May 22, 2020.
May 29, 2020	Chief, Referrals Inbox	Email – Outgoing	Team member emailed Chief of LSIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM’s approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to LSIB and TM would like to understand LSIB’s position on a potential Western Route. Team member mentioned that TM wrote to seek LSIB's input on the WAR and did not receive comments. Team member stated that TM looked forward receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM’s routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief	Email – Outgoing	Team member emailed Chief of LSIB and informed that Triton would like to invite a representative from LSIB to participate in field studies for the WAR in early July 2020. Team member advised that the field work would be three days long and

			consist of fish and fish habitat assessments along the proposed alternate pipeline route. Team member advised the crew would consist of two Triton employees plus a participant from Esh-kn-am and potentially other participants from interested communities. Team member requested that if the Chief was able to find a participant to join the aquatics crew, to let her know by June 15, 2020 to allow time for planning. Team member advised that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed a status update on TM's engagement on the WAR to Chief of LSIB. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to Chief of LSIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team member provided a link to access a copy of the letter on the CER's website. Team member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter, stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
September 02, 2020	Chief	Voicemail – Outgoing	Team member left a voicemail message for the Chief of LSIB, inquiring as to their stance on the WAR. Team member summarized correspondence previously

			provided to LSIB on WAR stating the premise is to explore the option of going around the aquifer beneath the Coldwater Reserve to the west. Team member inquired whether LSIB would support CIB's pursuit of the WAR and requested a callback.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LSIB, noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LSIB, seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of LSIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked LSIB to confirm its interest in participating by September 30, 2020.

Nicomen Indian Band (NIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief, Natural Resources Manager	Email – Outgoing	Team member emailed NIB representatives a letter on the consultation regarding a potential alternative route around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 30, 2020	Chief	Conference Call	Team members held a conference call with the Chief of NIB and provided updates on the Project. Team member provided an overview of the WAR. The Chief noted she was unable to view the PDF map previously sent based on file size. Team Member shared the PDF map on her screen for The Chief to view as the route was discussed. The Chief inquired of the potential for disturbance of well sites on the WAR. Team member said they would inquire about this possibility and get back to the Chief.
April 08, 2020	Chief	Email – Outgoing	Team member emailed the Chief of NIB and followed up on a question the Chief had regarding well sites on the WAR. Team member summarized that no wells had been identified as of yet, however as part of any future field work there would be a more fulsome study completed to identify any unregistered wells.
April 09, 2020	Chief, Natural Resources Manager	Email – Outgoing	Team member provided Chief of NIB an update on the status of the WAR Feasibility Study further to the referral which went out on February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that NIB advise if they wish to participate in this field

			program. Team member also provided a link to the current construction schedule.
April 23, 2020	Chief, Natural Resources Manager	Email – Outgoing	Team member emailed Chief of NIB and informed that TM was planning to drill two boreholes in May 2020 related to the WAR. Team member attached an updated map that showed the location of the boreholes and provided a description of the boreholes. Team member informed of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member noted that consultation would be ongoing and advised that a more detailed environmental field program may be required in the spring, the details of which would be shared as they become available. Team member requested that NIB advise if they wish to participate in the field program.
April 28, 2020	Chief	Email – Outgoing	Team member emailed Chief of NIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided details about the description of the work, key dates, and associated attachments. Team member inquired whether NIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
May 10, 2020	Chief	Email – Outgoing	Team member emailed Chief of NIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from NIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and

			maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether NIB was interested and explained that fieldwork requirements could be discussed by phone or email.
May 11, 2020	Chief, Legal Counsel	Email – Incoming	Chief of NIB emailed Team member and requested to be provided with the field work requirements and any additional information related to the WAR biophysical field work for NIB's review and consideration.
May 12, 2020	Legal Counsel, Chief	Email – Outgoing	Team member emailed Chief of NIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member informed that the surveys were related to soils, OGMA, vegetation, weeds, wetlands and wildlife. Team member provided a list of information required for the field work.
May 19, 2020	Legal Counsel, Chief	Email – Outgoing	Team member emailed Chief of NIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if NIB was interested in someone joining the crews to let her know by May 22, 2020.
May 26, 2020	Legal Counsel	Email – Incoming	Legal Counsel for NIB emailed Team member and asked what qualifications were required for the crew to work on the fieldwork for the WAR biophysical study.
May 26, 2020	Legal Counsel	Email – Outgoing	Team member emailed Legal Counsel for NIB and explained that no previous experience was required to participate in the fieldwork for the WAR biophysical study. Team member provided the training and safety requirements that needed to be completed before the fieldwork began and informed that, if NIB would like to send a crew member out on the wildlife study coming up in 1.5 weeks, Jacobs would need to start paperwork associated with the field right away.
May 26, 2020	Legal Counsel	Email – Incoming	Legal Counsel for NIB emailed Team member and thanked her for the information regarding the training and safety requirements for

			the WAR biophysical study fieldwork. NIB noted they would follow up with Team member soon.
May 29, 2020	Chief, Legal Counsel	Email – Outgoing	Team member emailed Chief of NIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to NIB and TM would like to understand NIB's position on a potential alternative route. Team member mentioned that, further to the letter of February 28, 2020, TM received comments from NIB regarding concerns with well locations but looked forward to any additional comments since the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 01, 2020	Chief, Legal Counsel	Email - Incoming	Chief of NIB emailed Team member and requested a Zoom meeting for TM to present on the WAR.
June 01, 2020	Chief, Legal Counsel	Email - Incoming	Chief of NIB emailed Team member and requested to resend the map for identifying the most practical WAR option, and a map of TM's approved (Eastern) route.
June 02, 2020	Chief	Email – Outgoing	Team member emailed Chief of NIB and informed that Triton would like to invite a representative from NIB to participate in field studies for the WAR in early July 2020. Team member advised that the field work would be three days long and consist of fish and fish habitat assessments along the proposed alternate pipeline route. Team member advised the crew would consist of two Triton employees plus a participant from Esh-kn-am and potentially other participants from interested communities. Team member requested that if the Chief was able to find a participant to join the aquatics crew, to let her know by June 15, 2020 to allow time for planning. Team

			member advised that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
June 10, 2020	Natural Resources Manager	Phone call - Incoming	Natural Resources Manager for NIB phoned Team member in response to a voicemail and discussed orientation planning details for the WAR biophysical study fieldwork.
June 15, 2020	Chief, Legal Counsel	Email - Incoming	Chief of NIB emailed Team member and followed up on her previous email requesting to resend the map for identifying the most practical WAR option, and a map of TM's approved (Eastern) route.
June 15, 2020	Legal Counsel	Email - Incoming	Legal Counsel for NIB emailed Team member and advised that the Chief and Council requested a three-week extension to provide feedback regarding the WAR. NIB stated they would like to schedule a time for a presentation by video conference.
June 15, 2020	Legal Counsel	Email – Outgoing	Team member emailed Legal Counsel for NIB and suggested to meet either on June 17 or 18, 2020 and if neither of those dates worked for NIB, to offer some dates in the coming weeks. Team member advised that TM would be continuing to engage on the WAR past the deadline of June 15, 2020 to answer questions and engage on interests and concerns. Team member informed that based on this ongoing consultation, there was no need for a formal extension for NIB to comment or engage on the WAR; however, TM might have to make a routing decision prior to NIB's final feedback based on the CER filing deadlines. Team member noted that she could send an alternative map, however it might be in PDF form depending on what capabilities their computer had. Team member inquired if NIB representative had GIS capability on her computer.
June 17, 2020	Chief, Council	Email exchange	Chief of NIB exchanged emails with Team member to inform that she was available for a Zoom meeting on June 18, 2020, but Council might not be available. NIB Council asked Team member to suggest some dates during the week of June 22, 2020. Team member worked with Council members and circulated a Doodle Poll to see if they all had some common availability to meet during the week of June 22, 2020.

June 24, 2020	Chief, Council	Email exchange	Team member exchanged emails with Chief and Council of NIB and inquired about availability for a call regarding the WAR. NIB inquired whether Team member could re-circulate a Doodle Poll regarding the availability for a meeting in the next few weeks.
June 25, 2020	Chief, Council	Email exchange	Team member exchanged email with NIB representatives and provided a link for the Doodle Poll regarding meeting availability to discuss the WAR. Team member thanked NIB for updating their availability and suggested a couple of possible meeting options for consideration.
July 14, 2020	Legal Counsel	Email - Incoming	Legal Counsel for NIB asked for Team Member to resend a map of the WAR in pdf format.
July 20, 2020	Legal Counsel	Email – Outgoing	Team Member emailed Legal Counsel for NIB and offered to meet to discuss the WAR. Team Member provided some dates/times that her colleagues were available and asked for NIB's availability.
July 21, 2020	Legal Counsel	Email – Exchange	Team Member exchanged emails with Legal Counsel for NIB and arranged a meeting for July 27, 2020 in the afternoon to discuss the WAR.
July 22, 2020	Legal Counsel	Email - Outgoing	Team member sent map of the WAR to NIB representative as requested.
July 27, 2020	Legal Counsel	Virtual meeting	Team Member met virtually with Legal Counsel representative from NIB and provided an overview of the WAR and answered questions.
July 28, 2020	Chief, Council	Email – Outgoing	Team Member emailed Chief of NIB and representatives and provided the WAR presentation given to NIB on July 27, 2020. Team Member informed that TM could repeat the presentation if Chief and Council were interested.
July 28, 2020	Chief, Council	Email – Incoming	Team Member received a bounce back email from all NIB representatives that were sent the presentation saying that the size limit was exceeded.
July 31, 2020	Chief, Council	Email – Outgoing	Team Member emailed representatives of NIB and informed them that a requested secure folder for NIB to review documentation was set up. Team Member noted each individual would receive an email directly from SharePoint for access, and once the site was accessed, there was a folder labelled 2020-07-30 WAR containing the files for review.

August 05, 2020	Landmark Resources Management (LRM)	Email – Exchange	NIB’s consultant, LRM, emailed Team member requesting shapefiles for the WAR and approved Project corridor in order to prepare Traditional Land Use (TLU) impact assessment maps. Team member emailed back confirming they were looking to receive shapefiles for NIB. LRM confirmed and requested a phone call to provide context around the WAR. Team member provided her contact information and availability for a phone call and sent a map of the WAR. Team member stated she would follow-up in a separate email for shapefiles.
August 05, 2020	LRM	Phone call – Outgoing	Team member phoned NIB’s consultant, LRM, further to their request for shapefiles. LRM noted they were working with AIB and NIB on TLUS funded through the NRCan Phase 3 Terrestrial Studies Initiative. LRM and Team member discussed timelines for getting the work completed. LRM explained that it hoped the work would be complete by early 2021 for NIB. Team member explained that TM was considering a WAR in response to CIB’s desire to avoid the aquifer beneath the Coldwater Reserve that is the source of drinking water in the area. Team member asked if LRM would also like the footprint of this potential route. LRM stated that they would. Team member committed to sending LRM shapefiles of the WAR.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed a status update to the Chief of NIB on TM’s engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB’s position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER’s consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.

August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of NIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 12, 2020	LRM	Email – Outgoing	Team member responded to LRM's August 5, 2020 request to provide shapefiles for the WAR and the available information for facility locations, including stockpile sites. Team member offered to answer any questions and to keep in contact regarding progress and decision-making on the WAR.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up with Chief of NIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of NIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.

September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of NIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of NIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked NIB to confirm its interest in participating by September 30, 2020.
September 16, 2020	Legal Counsel	Email - Outgoing	Team member emailed NIB Legal Counsel to inquire if she had seen an email sent earlier that day regarding the opportunity for an NIB representative to participate in an upcoming site visit and assessment.
September 24, 2020	Natural Resources Manager	Email – Exchange	The NIB Natural Resources Manager emailed Team member to inquire of her availability for a call to discuss the WAR. Team member responded with dates and times she was available for a call the week of September 28, 2020.
September 24, 2020	Legal Counsel	Email – Incoming	The NIB Legal Counsel emailed Team member saying she would canvass interest in NIB's participation in the one-day site visit assessment.
September 29, 2020	Natural Resources Manager	Email – Exchange	The NIB Natural Resources Manager emailed Team member to confirm the time for a call to discuss the WAR. Team member confirmed a call for 10:00 am on September 30, 2020.
October 01, 2020	Chief	Conference Call	Conference call between TM and NIB with Team member providing an overview of the WAR including the current regulatory stage and process of studying the WAR. NIB stated they would not be studying

			the WAR as part of the Traditional Use Studies offered through the Crown. NIB inquired about a cultural use study. Team member noted that this could be a topic for future consideration if TMEP decided to pursue the proposed WAR.

Nlaka’pamux Nation Tribal Council (NNTC)

Date	Community contacts	Method	Communication
February 28, 2020	Implementation Manager, Environmental Advisor	Email – Outgoing	Team member emailed a letter to NNTC representatives dated February 28, 2020 about TM's consultation regarding the potential WAR around the Coldwater Reserve. The letter informed that TM was engaging with CIB on routing for the Project, in particular exploring a route option referred to as the WAR for further analysis and discussion. The letter stated that TM recognized that the consideration of any route alternative required consultation with those Indigenous groups who may potentially be affected. The letter noted that TM respectfully sought NNTC's input regarding the potential WAR that was under consideration and contemplated placement of the new 36” expansion line on a route located west of the Coldwater Reserve. The letter provided the status of feasibility work for the potential WAR and timeline for assessment. The letter stated that TM would appreciate receiving of any input from NNTC by March 20, 2020, and that they would follow up in the interim to discuss the matter.
March 02, 2020	Environmental Advisor	Email – Outgoing	Team member emailed NNTC representatives and advised that documentation regarding the WAR and other Project-related information had been uploaded to the NNTC SharePoint site.
March 09, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives requesting confirmation they received the email and attachments regarding the WAR and that the upload to their FTP site was successful. Team member noted that it was on the agenda for the meeting on March 11, 2020.
March 11, 2020	Environmental Advisor, Implementation Manager	In-person meeting	Team members held a Technical Teams meeting with NNTC representatives and discussed various critical path matters, including the WAR. TM provided an overview of the WAR in follow-up to the documents uploaded to the NNTC SharePoint site on March 2, 2020. TM also provided a concordance table of documents/data sent to NNTC from April 2013 to March 10, 2020.
April 14, 2020	Environmental Advisor, Implementation Manager	Email - Incoming	NNTC representatives provided a summary table of NNTC's concerns to action items from a joint NNTC / TM March 11, 2020 Technical Teams meeting, including the WAR. NNTC explained that they needed to complete a review and compile any issues, information requests or recommendations on the WAR. The

			NNTC summary table expressed a concern that NNTC had no involvement in the WAR archaeology or environmental work to date.
April 14, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and acknowledged receipt of NNTC's response to action items from an April 2, 2020*NNTC / TM Engagement Board* meeting, as well as the previously supplied Summary Table of NNTC concerns. Team member indicated he would review the information and follow up.
April 22, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	In response to the concern raised in the Summary Table of NNTC Concerns (noted above), where NNTC indicated it had no involvement in the WAR, Team member emailed NNTC representatives stating that in November 2019, Jacobs undertook a biophysical reconnaissance that covered most groundwork and prior field work, and had invited NNTC to participate in the survey. Team member provided the link to the results of those studies that had been compiled in the WAFS Report filed with the CER. Team member advised that the WAFS Report had been public since April 15, 2020 and noted that the feasibility study of the WAR had also been uploaded to the NNTC SharePoint site.
April 23, 2020	Environmental Advisor, Implementation Manager	Conference Call	Team members held a technical team meeting via conference call with NNTC representatives. Parties discussed various matters, including NNTC participation in the WAR environmental field studies.
April 23, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member provided NNTC representatives with an update further to the February 28, 2020 email. Team Member informed that the WAFS Report was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available, clarifying that engagement will not end at the time of filing of the feasibility study on March 31, 2020.
May 06, 2020	Environmental Advisor,	Email – Outgoing	Team member informed NNTC representatives of the completion and submission of the WAFS Report and provided a link to where it could be found. Team

	Implementation Manager		member requested that the NNTC advise if they wish to participate in upcoming field programs.
May 08, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives advising of a borehole investigation to be conducted by BGC Engineering on behalf of TM along the WAR to support its understanding of a potential HDD crossing of the Coldwater River. Team member provided information on how the work would be executed, informed the work would be conducted from May 4 to May 17, 2020 and listed the activities to take place on specific dates. Team member provided BGC's execution plan, shapefiles for the two boreholes sites, and a PDF map of the borehole locations. Team member requested that NNTC contact him should they be interested in monitoring the work.
May 13, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed the NNTC Implementation Manager about the upcoming biophysical field study related to the WAR to occur in June. Team member stated TM would like to invite one NNTC representative if interested and available to join as a crew member. Team member outlined field study details including the expected 2-3 week duration, COVID-19 precautions, and that crews would be visiting targeted locations across the WAR to conduct wildlife, vegetation, wetlands, soils and OGMA studies.
May 13, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and provided information related to the Environmental and Socio-Economic Assessment (ESA) review for the WAR. Team Member and NNTC discussed NNTC's participation in, and review of, the ESA.
May 13, 2020	Environmental Advisor	Email – Outgoing	Team member emailed NNTC Environmental Advisor and advised that the execution plan, shapefiles and maps for the borehole investigation had been uploaded into NNTC's SharePoint site.
May 13, 2020	Implementation Manager	Email - Incoming	The NNTC Implementation Manager emailed Team member and advised she would review the information provided for the ESA on the WAR.
May 15, 2020	Environmental Advisor	Email – Incoming	The NNTC Environmental Advisor emailed Team member and inquired if he and his colleague from Jacobs would be available for a phone call to clarify work on the Wildlife Resource Specialist for the WAR.
May 15, 2020	Environmental Advisor	Email – Outgoing	Team member emailed NNTC Environmental Advisor and advised that he had copied his colleague at Jacobs on NNTC's email request to meet regarding the upcoming Wildlife Resource Specialist work for the WAR.

May 29, 2020	Implementation Manager	Email – Outgoing	Team member emailed NNTC Implementation Manager and requested feedback on the impact that the WAR would have on the community. Team member advised that the WAFS Report had been filed with the CER and provided the weblink to the report. Team member advised that TM was in discussions with CIB to seek consensus on a route through Coldwater Valley. Team member advised that the two route options were the WAR and the approved Eastern Route. Team member requested that NNTC provide their comments by June 15, 2020 as a decision on the route would be made in the Summer of 2020. Team member noted that TM could organize a video presentation on the WAR and invited NNTC to contact Team member with any questions they may have.
May 29, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and advised that the WAR shapefiles had been uploaded to the NNTC SharePoint.
June 02, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and provided an updated version of the scope of work for the ESA on the WAR.
June 05, 2020	Environmental Advisor, Implementation Manager	Email - Incoming	NNTC representative emailed Team member and advised that NNTC had concerns with some of the wording in the scope of work for the ESA on the WAR.
June 06, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and provided an updated version of the WAR Wildlife field study for review. Team member noted that completion of wildlife and wildlife habitat field surveys is to meet the requirements of the CER Section 190 variance application, Project condition requirements, and any agreed-upon gaps as identified by NNTC.
June 07, 2020	Environmental Advisor, Implementation Manager	Email - Incoming	NNTC representatives emailed Team member and provided feedback on some of the wording in the scope of work.
June 17, 2020	Environmental Advisor,	Email – Outgoing	Team member emailed NNTC representatives and provided an updated document for the ESA review on the WAR (ESA Review) that included comments

	Implementation Manager		by Jacobs. Team member advised that the changes made by Jacobs were tracked to make it easier for NNTC to review. Team member requested that NNTC provide their feedback by June 19, 2020 so that work plans could be finalized by June 24, 2020.
July 15, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and provided a finalized version of the ESA Review that incorporated NNTC comments.
July 15, 2020	Environmental Advisor, Implementation Manager	Email – Outgoing	Team member emailed NNTC representatives and provided the aquatics field program methods to be used on the WAR work for NNTC to review.
August 07, 2020	Implementation Manager	Letter – Outgoing	Team member emailed a letter to NNTC representatives filed with the CER on July 29, 2020. In the letter, TM notified the CER that it was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to NNTC's respective TM Indigenous Relations Advisor.
August 17, 2020	Implementation Manager, Title Protector	In person meeting	In person meeting between TM and NNTC on various topics, including the WAR. At the meeting, the parties agreed to the following action items: • TM to share current AIA WAR Archeology Permit amendment and upload to NNTC SharePoint site. • TM to upload all WAR survey, alignment and methodology to NNTC SharePoint site including areas of potential (AOPs) and anticipated shovel tests. • TM to continue providing NNTC with regular updates with regard to the WAR. • TM to arrange a follow-up call with TM's Environmental lead to discuss feedback process for the results of the ESA Review
August 20, 2020	Implementation Manager, Environmental Advisor	Email - Outgoing	Team member emailed NNTC Implementation Manager and Environmental Advisor to inform them that, as agreed to at the August 17, 2020 in-person meeting, the documents regarding the WAR Archeology Permit amendment,

			survey alignment and methodology had been uploaded to the NNTC SharePoint site.
August 20, 2020	Director of Operations	Email – Incoming	NNTC representative emailed Team member the ESA Review document, which included NNTC's comments on the draft ESA.
August 20, 2020	Implementation Manager	Letter – Outgoing	Team member followed up on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, confirming the Indigenous Relations Advisor's availability to respond to any questions.
August 26, 2020	Implementation Manager	Conference call	NNTC and Team members held weekly conference call to discuss the WAR. TM agreed to set up a call between NNTC and TM's Environment Team to discuss the feedback from NNTC on the ESA. Team member raised that TM was anticipating filing a Section 190 route variance with the CER for the WAR and would be stating the position of all impacted Indigenous groups. Team member stated TM would like to convey what NNTC's position is on supporting the WAR and requested that NNTC provide that to TM as NNTC position has not been received to date. NNTC Implementation Manager advised that NNTC wants all engagement on the WAR to go through NNTC and not the NNTC member bands
September 02, 2020	Implementation Manager	Teleconference	Team members from TM's Environment Team met via teleconference with NNTC Implementation Manager to discuss feedback mechanisms for NNTC's comments and recommendations on the ESA draft. Team member agreed to send NNTC a table that lists the NNTC concerns and recommendations for the ESA and TM's responses to each.
September 09, 2020	Implementation Manager, Environmental Advisor	Email – Outgoing	Team member emailed NNTC representatives responding to inquiries raised during the August 17, 2020 meeting. Team member shared the following information on the outstanding archaeology work in NNTC territory: 1. Mapbook for the WAR shows the AOPs, including which ones have been tested vs which one need to be tested.

			2. Table listing the WAR AOPs and either the number of estimated tests (if testing is still needed) or the number of tests completed (if testing is complete). TM advised that a zip file on the WAR footprint would be uploaded. TM advised that once NNTC reviews the information a meeting can be scheduled to provide clarification on any of the information provided.
September 09, 2020	Implementation Manager, Environmental Advisor	Email - Outgoing	Team member emailed NNTC Implementation Manager and Environmental Advisor informing them that documents for the archaeology work on the WAR, including summary mapbooks and schedules for the NNTC Territory, had been uploaded to the NNTC SharePoint site.
September 09, 2020	Implementation Manager, Environmental Advisor	Email – Outgoing	Team member emailed the NNTC Implementation Manager and Environmental Advisor noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain’s preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 10, 2020	Implementation Manager, Environmental Advisor	Email – Outgoing	Team member emailed NNTC representatives a table listing the NNTC concerns and recommendations in relation to the draft ESA and TM’s responses.
September 11, 2020	Implementation Manager, Environmental Advisor	Email – Outgoing	Team member emailed the NNTC Implementation Manager and Environmental Advisor seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain’s application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions on the potential alternative crossings.
September 16, 2020	Implementation Manager,	Email – Outgoing	Team member emailed NNTC Implementation Manager and Environmental Advisor to inform them of the opportunity for an NNTC representative

	Environmental Advisor		participate in a site visit to the proposed Coldwater River southern crossing. A description of the one-day site visit was provided and would include an assessment of the new DPI crossing under the Coldwater River and the accompanying proposed temporary workspaces and drag section. Team member stated the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Team member stated to let him know if there was interest in participating by September 28.
September 17, 2020	Implementation Manager	Email – Outgoing	Team member emailed the NNTC Implementation Manager regarding their request to see the wording from the CER on the WAR consultation process with Indigenous groups saying he was advised that the CER did not provide any specific instructions to TM. Team member stated once the application is filed, the CER would be seeking input from Indigenous groups on the application and NNTC would have an opportunity to provide comments. Team member referred to TM's August 6, 2020 letter which outlined TM's interest in understanding NNTC's position supporting CIB's pursuit of the WAR. Team member stated to date TM has not received a position from NNTC and therefore have summarized the following feedback for the application: • NNTC has requested to review environmental studies regarding the WAR • NNTC has raised archeological concerns and active discussions are ongoing to address concerns
September 17, 2020	Director of Operations, Implementation Manager, Environmental Advisor	Email – Incoming	The Director of Operations of the NNTC responded to Team member's September 10, 2020 email stating he would provide comments to the table by end of day September 23, 2020, and that a few outstanding issues remained. NNTC representative said they were also looking to obtain copies of the updated reports.
September 17, 2020	Director of Operations, Implementation Manager, Environmental Advisor	Email – Incoming	The Director of Operations of the NNTC responded to Team member's email of September 11, 2020 confirming receipt of the alternative crossings method and stated they would review the information and respond with any questions or comments.

September 23, 2020	Implementation Manager, Environmental Advisor	Email – Outgoing	Team member emailed the NNTC Implementation Manager and Environmental Advisor to provide them of the following documents: • Notice of Intent to Conduct Archaeological Field Studies under Heritage Inspection Permit 2015-0258 • Application for Heritage Inspection Permit 20A0269 • spatial files including shapefiles, kmz and geomark. Team member stated that these documents were also uploaded to the NNTC SharePoint in the folders: Archaeology and Potential Western Alternative Route. Team member offered their availability to respond to any questions or concerns.

Boothroyd Indian Band (BIB) (NNTC Member Nation)

Date	Community contacts	Method	Communication
August 06, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed Chief of BIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR requesting that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed a letter to the Chief of BIB. The letter dated July 29, 2020, was written to the CER Commission. In the letter, TM notified the CER that it was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Chief	Email – Outgoing	Team member emailed Chief of BIB to follow up on the August 6, 2020 letter and map. Team member requested confirmation of receipt and inquired as to whether there were any questions. Team member offered his availability to answer any questions or concerns.
August 20, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member followed up with Chief of BIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where

			it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Email – Outgoing	Team member emailed Chief of BIB to follow-up on the August 6, 2020 email. Team member stated he reached out on August 11, 2020, to confirm receipt of the letter and map enclosed in the August 6, 2020 email and offered his availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of BIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.

Lytton First Nation (LFN) (NNTC Member Nation)

Date	Community contacts	Method	Communication
August 06, 2020	Chief LFN, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed Chief of LFN a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed a letter to the Chief of LFN. The letter dated July 29, 2020, was written to the CER Commission. In the letter, TM notified the CER that it was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LFN to follow up on the August 6, 2020 letter and map. Team member requested confirmation of receipt and inquired as to whether there were any questions. Team member offered his availability to answer any questions or concerns.
August 20, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member followed up with the Chief of LFN on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to

			where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Email – Exchange	Team member emailed the Chief of LFN to follow-up on the August 6, 2020 email. Team member stated he reached out on August 11, 2020 to confirm receipt of the letter and map enclosed in the August 6, 2020 email and offered his availability to respond to any questions. The Chief of LFN responded stating LFN would be working with the NNTC on these referrals through the shared decision-making board. The Chief of LFN asked Team member to follow up with the Chief of Oregon Jack Creek Band and/or NNTC Implementation Manager. Team member responded in acknowledgement.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LFN noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of LFN seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.

Skuppah Indian Band (SIB) (NNTC Member Nation)

Date	Community contacts	Method	Communication
August 06, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed the Chief of SIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of SIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Chief, Implementation Manager (of NNTC)	Email – Outgoing	Team member emailed the Chief of SIB to follow up on the August 6, 2020 letter and map. Team member requested confirmation of receipt and inquired as to whether there were any questions. Team member offered his availability to answer any questions or concerns.
August 20, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member followed up with the Chief of SIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to

			where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SIB to follow-up on the August 6, 2020 email. Team member stated he reached out on August 11, 2020 to confirm receipt of the letter and map enclosed in the August 6, 2020 email and offered his availability to respond to any questions on the August 6, 2020 letter and map.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.

Oregon Jack Creek Band (OJCB) (NNTC Member Nation)

Date	Community contacts	Method	Communication
August 06, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed the Chief of OJCB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related field work and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed a letter to the Chief of OJCB. The letter dated July 29, 2020, was written to the CER Commission. In the letter, TM notified the CER that it was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of OJCB to follow up on the August 6, 2020 letter and map. Team member requested confirmation of receipt and inquired as to whether there were any questions. Team member offered his availability to answer any questions or concerns.
August 20, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member followed up with the Chief of OJCB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to

			where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Email – Outgoing	Team member emailed the Chief of OJCB to follow-up on the August 6, 2020 email. Team member stated he reached out on August 11 2020 to confirm receipt of the letter and map enclosed in the August 6, 2020 email and offered his availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of OJCB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of OJCB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.

Spuzzum First Nation (SUFN) (NNTC Member Nation – withdrawing from Tribal Council)

Date	Community contacts	Method	Communication
July 30, 2020	Chief, Council, Implementation Manager (of NNTC)	Phone call - Incoming	The Chief of SUFN phoned Team Member and introduced his Councillors and advised that SUFN wished to engage separately with TM, and independently from the NNTC. The Council advised that they were proceeding with a withdrawal from NNTC and developing their own Heritage Policy and Engagement process. The Chief of SUFN noted that he received a call from the Chief of CIB regarding SUFN's support for the WAR. The Council advised of their support for the WAR and they understood that CIB would support them if a Project ran through their core territory. The Chief of SUFN noted that a letter would be sent during the week of August 3, 2020 to confirm SUFN's decision.
August 06, 2020	Chief, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed the Chief of SUFN a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 06, 2020	Chief, Council, Implementation Manager (of NNTC)	Letter – Incoming	SUFN representative emailed a letter to Team member. The letter dated August 6, 2020 from the Chief of SUFN and Council advised that they expected direct communications with TM which included discussions and recommendations regarding, but not limited to, the WAR and WAFS.
August 06, 2020	Chief, Council, Implementation Manager (of NNTC)	Email – Outgoing	Team Member emailed SUFN representatives and acknowledged receipt of their letter regarding direct engagement. Team Member inquired whether SUFN had potential meeting dates for consideration.

August 07, 2020	Chief, Assistant Housing/Land Manager of SUFN, Implementation Manager (of NNTC)	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to SUFN representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 18, 2020	Chief, Council, Assistant Housing/Land Manager of SUFN, Implementation Manager (of NNTC)	Email – Exchange	Team member exchanged email with SUFN representative and inquired about dates of availability for a meeting regarding the WAR. SUFN inquired whether Team member was available on August 27 or 28, 2020, as those days were typically good for Chief and Council. Team Member responded that either date worked for him.
August 19, 2020	Chief, Assistant Housing/Land Manager of SUFN, Implementation Manager (of NNTC)	Email – Exchange	Team member exchanged emails with SUFN representative and confirmed his availability for a meeting on August 28, 2020 with Chief and Council. Team member inquired about logistics for the meeting, and a list of items that SUFN wished to discuss. SUFN included Team member on the email which inquired whether Chief and Council were available for August 28, 2020.
August 20, 2020	Chief, Assistant Housing Manager, SUFN, Implementation Manager (of NNTC)	Letter – Outgoing	Team member followed up with SUFN representatives on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 20, 2020	Chief, Assistant Housing/Land Manager of SUFN,	Email – Outgoing	Team member emailed SUFN representative and inquired if it was possible to receive a copy of a letter sent from SUFN to NNTC on June 22, 2020. Team member advised that at the next meeting with SUFN he wished to provide an update on the WAR, background and current status. Team member advised that SUFN should receive direct correspondence from TM regarding support

	Implementation Manager (of NNTC)		for CIB on their pursuit of the WAR, TM's intentions regarding a s 190 variance application, and a communication related to the ongoing validity of the approved Eastern Route in conjunction with CIB and other Indigenous groups. Team member noted that he was open to other agenda items that SUFN wished to discuss.
August 25, 2020	Chief, Assistant Housing/Land Manager of SUFN, Implementation Manager (of NNTC)	Email – Exchange	Chief of SUFN responded to Team member’s August 20, 2020 email stating he was in discussions with SUFN Council, Team member, and the Chief of CIB. The Chief of SUFN advised that SUFN would be honoring the Chief of CIB’s request for their support of his council taking the lead on the proposed realignment which was in close proximity to the CIB. The Chief of SUFN stated he would be speaking with the Chief of CIB that afternoon. Team member responded thanking the Chief for the update on SUFN’s position.
August 25, 2020	Chief, Assistant Housing/Land Manager of SUFN, Implementation Manager (of NNTC)	Email – Incoming	Chief of SUFN emailed Team member confirming availability to meet August 28, 2020 in Chilliwack, BC.
August 27, 2020	Chief, Assistant Housing/Land Manager of SUFN, Implementation Manager (if NNTC)	Email – Outgoing	Team member emailed the Chief of SUFN and Council with meeting logistics and agenda for the August 28, 2020 meeting. Agenda items included an overview of the WAR and the section 190 variance application, an update on the status on SUFN’s withdrawal from NNTC and SUFN’s support for CIB’s pursuit of WAR, including the possibility of a letter response to the August 6, 2020 email from Team member.
August 28, 2020	Chief, Assistant Housing/Land Manager of SUFN	In person meeting	Meeting held to discuss the WAR and the section 190 variance application. Topics also included SUFN’s recent withdrawal from NNTC and their position on the WAR.

August 28, 2020	Chief, Assistant Housing/Land Manager	Letter - Incoming	SUFN representative emailed a letter of support for the WAR signed by the Chief of SUFN. The letter stated that SUFN supports Coldwater's pursuit of the West Alternative route for the Project and confirmed SUFN's desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required.
September 09, 2020	Chief, Assistant Housing/Land Manager, Councillor	Email – Outgoing	Team member emailed the Chief of SUFN noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 12, 2020	Chief, Assistant Housing/Land Manager, Councillor	Email - Outgoing	Team member emailed SUFN referencing the September 09,2020 email regarding the north crossing of the Coldwater River stating TM forgot to include a map of the proposed alternative methods and location. Team member attached the map and stated his availability if there were any questions.

Nooaitch Indian Band (NHIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief, Lands and Resources Manager	Email – Outgoing	Team member emailed NHIB representatives a letter on consultation regarding the potential alternative route around the Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
April 09, 2020	Lands and Resources Manager	Email – Outgoing	Team member provided NHIB representative with an update on the status of the WAFS further to the referral of February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that NHIB advise if they wish to participate in this field program.
April 28, 2020	Chief, Lands and Resources Manager	Email – Outgoing	Team member emailed the Chief and Lands and Resources Manager of NHIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether NHIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM’s efforts to protect communities and workers in light of COVID-19.
May 10, 2020	Chief, Lands and Resources Manager	Email – Outgoing	Team member emailed the Chief of NHIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from NHIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and

			ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether NHIB was interested, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief, Lands and Resources Manager	Email – Outgoing	Team member emailed the Chief of NHIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if NHIB was interested in someone joining the crews to advise by May 22, 2020.
May 29, 2020	Chief	Email – Outgoing	Team member emailed the Chief of NHIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to NHIB and TM would like to understand NHIB's position on a potential alternative route. Team member mentioned that TM wrote to seek NHIB's input on the WAR but had not received any comments. Team member stated that TM looked forward to receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief	Email – Outgoing	Team member emailed Chief of NHIB and introduced herself as an Aquatics/Fisheries Biologist for Triton Environmental. Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member stated that Triton would like to invite a representative from NHIB or alternatively through STC to join Triton's field crew. Team member advised that the aquatics field program consisted of fish and fish habitat assessments at potential watercourse crossings along the proposed WAR.

			The assessments would be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member stated if the Chief of NHIB was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
June 02, 2020	Chief, Lands and Resources Manager, Biologist (of STC), Quality Control Technologist (of STC)	Email – Incoming	NHIB Lands and Resources Manager emailed Team member and indicated that a NHIB representative could participate in the field crew if they were available at that time. NHIB Lands and Resources Manager recommended that a staff member from the Nicola Stewardship Fisheries Authority of STC be included in the field crew and requested to follow up with STC representative to confirm availability.
June 02, 2020	Lands and Resources Manager	Phone call - Incoming	NHIB Land and Resources Manager phoned Team member and followed up on his email regarding participation in the aquatics field work. NHIB discussed the Thompson steelhead, a critically endangered species due to drought conditions and high temperatures, and how the province only implemented water withdrawal restrictions on the Coldwater River recently. NHIB also discussed a fish storage option around Coldwater Indian Reserve No. 2 and inquired if the routing option would interfere with the plan. NHIB suggested for Team member to contact STC to confirm staff availability and suggested two participants: an NHIB member, and a member of the Nicola Stewardship Fisheries Authority.
June 16, 2020	Lands and Resources Manager, Band Administrator (of LNIB), Quality Control Technologist (of STC),	Email - Outgoing	Team member emailed representatives of STC, LNIB and NHIB, and informed that she had received some details about training/safety requirements for the upcoming 2-day aquatics fieldwork. Team member requested that each field personnel complete the orientation and send their evidence of completion to her by June 26, 2020. Team member provided details about the online orientation, Personal Protection Equipment requirements, COVID-19 protocols, and logistics.

	Manager (of STC), Eshknam CRMS Archaeology (Esh-Kn-Am Cultural Resources Management Services)		
June 24, 2020	Band Administrator (of LNIB), Quality Control Technologist (of STC), Manager (of STC), Lands and Resources Manager, Eshknam CRMS Archaeology (Esh-Kn-Am Cultural Resources Management Services)	Email – Outgoing	Team member emailed representatives of STC, LNIB and NHIB, and proposed July 7 and 8, 2020 as the two field dates for the upcoming aquatics work. Team member requested to know as soon as possible if the dates worked for the field technicians/biologists. Team member reminded everyone to complete the TM orientations, as she would like to submit them to TM by June 29, 2020.
June 24, 2020	Lands and Resources Manager, Band Administrator (of LNIB),	Email - Incoming	STC Biologist emailed Team member and informed that July 7 and 8, 2020 worked for the two fisheries staff from STC participating in the aquatics program.

	Quality Control Technologist (of STC), Manager (of STC), Eshknam CRMS Archaeology (Esh-Kn-Am Cultural Resources Management Services)		
July 07, 2020	Executive Director (of STC), Band Manager, Receptionist (of SHIB)	Letter – Incoming	STC Executive Director emailed Team member a letter on behalf of Shackan Indian Band and NHIB regarding the WAR and the HDD on the two boreholes at locations BGC20-CW6-01 and BGC20-CW6-01-02. The letter dated July 6, 2020, advised that STC's research group, Tmix Research, had identified multiple sites of cultural value located in both borehole locations that infringe upon Cultural Survival Areas (CSA). The letter noted that Tmix Research would require a CSA assessment and preliminary field reconnaissance. The letter advised that Tmix Research recognized that Coldwater Indian Reserve No. 2 (Paul's Basin) was adjacent to and impacted the proposed drilling work. The letter noted that Tmix Research would support the decision made by CIB and wished to ensure CIB's involvement prior to any work being conducted.
August 04, 2020	Executive Director (of STC)	Letter – Outgoing	Team member emailed STC Executive Director a response letter to STC's July 7, 2020 letter regarding the geotechnical investigation on the two boreholes located at BGC20-CW6-01 and BGC20-CW6-01-02. Team Member advised that both borehole drills were located on private lands and that TM had indicated in notifications, sent via email, that both drills were to be completed by May 18, 2020 and that the drilling programs had been completed. The letter provided a summary of borehole related activities. The letter advised that any questions or concerns be directed to the TM Indigenous Relations Advisor.

August 06, 2020	Chief, Lands and Resources Manager	Letter – Outgoing	Team member emailed the Chief of NHIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Lands and Resources Manager	Voicemail – Outgoing	Team member left a message for NHIB Lands and Resources Manager and advised she wished to discuss several matters including the WAR. Team Member offered to set up a meeting with NHIB.
August 07, 2020	Chief, Lands and Resources Manager	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to NHIB representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 14, 2020	Chief, Council, Lands and Resources Manager, NHIB, Chief (of CIB)	Letter – Incoming	NHIB representatives emailed a letter to Team members regarding the WAR. The letter dated August 12, 2020 confirmed that on behalf of NHIB, they supported CIB's pursuit of the WAR for the Project. The letter advised of NHIB's desire to engage with TM in good faith to advance the WAR.
August 20, 2020	Chief, Lands and Resources Manager	Letter – Outgoing	Team member followed up with NHIB representatives on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where

			it was filed, confirming the TM Indigenous Relations Advisor's availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of NHIB noting that TM was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is TM's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of NHIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of NHIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked NHIB to confirm its interest in participating by September 30, 2020.

Okanagan Indian Band (OIB)

Date	Community contacts	Method	Communication
February 28, 2020	Executive Assistant	Email – Outgoing	Team member emailed OIB representatives a letter on consultation regarding the potential alternative route around the Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Territorial Stewardship Director	Email – Outgoing	Team member emailed OIB Territorial Stewardship Director and followed up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member asked if OIB had any initial feedback or would like to set up a meeting.
April 09, 2020	Executive Assistant, Territorial Stewardship Director	Email – Outgoing	Team member provided OIB representatives with an update on the status of the WAR Feasibility Study further to the referral that went out on February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that OIB advise if they wish to participate in this field program.
April 23, 2020	Executive Assistant, Territorial Stewardship Director	Email – Outgoing	Team member provided OIB representatives with an update further to the February 28, 2020 email. Team Member informed that the feasibility study for the WAR was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the feasibility study on March 31, 2020.

April 28, 2020	Territorial Stewardship Director	Email – Outgoing	Team member emailed OIB representative about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether OIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
May 06, 2020	Executive Assistant, Territorial Stewardship Director	Email – Outgoing	Team member informed OIB representatives of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member requested that OIB advise if they wish to participate in the field program.
May 10, 2020	Chief, Territorial Stewardship Director	Email – Outgoing	Team member emailed the Chief and Territorial Stewardship Director of OIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from OIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether OIB was interested, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief, Territorial Stewardship Director	Email – Outgoing	Team member emailed Chief of OIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if OIB was interested in someone joining the crews to let her know by May 22, 2020.

May 19, 2020	Cultural Heritage inbox	Email – Outgoing	Team member emailed Cultural Heritage inbox and forwarded an email that was sent to OIB representative based on her out-of-office request. The email was regarding the schedule and potential participation on the WAR biophysical study, June 8 to July 3, 2020.
May 29, 2020	Chief, Territorial Stewardship Director	Email – Outgoing	Team member emailed the Chief of OIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to OIB and TM would like to understand OIB's position on a potential alternative route. Team member mentioned that TM wrote to seek OIB's input on the WAR and did not receive any comments. Team member stated that TM looked forward to receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief, Territorial Stewardship Director	Email – Outgoing	Team member emailed Chief of OIB and informed that Triton would like to invite a representative from OIB to participate in field studies for the WAR in early July 2020. Team member advised that the field work would be three days in duration and would consist of fish and fish habitat assessments along the proposed alternate pipeline route. Team member advised the crew would consist of two Triton employees plus a participant from Esh-kn-am and potentially other participants from interested communities. Team member requested that if the Chief was able to find a participant to join the aquatics crew, to let her know by June 15, 2020 to allow time for planning. Team member advised that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
August 06, 2020	Chief, Territorial Stewardship Director	Letter – Outgoing	Team member emailed the Chief of OIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related

			issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR requesting that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief, Territorial Stewardship Director	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to OIB representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief, Territorial Stewardship Director	Letter – Outgoing	Team member followed up with OIB representatives on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Phone call – Outgoing	Team member phoned the Chief of OIB regarding the WAR. The Chief noted that he was on holidays and asked to have a return phone call about the topic on or after September 11, 2020 when he returned. Team member said she would phone back at this time.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of OIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD

			crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of OIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton Environmental Consultants (Triton), emailed OIB of the opportunity to participate in an upcoming one-day site visit assessment of the proposed DPI crossing under the Coldwater River, and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton stated to inform them of interest in participating by September 30, 2020.

Penticton Indian Band (PIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB a letter on consultation regarding the potential alternative route around the Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB and followed up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member inquired if PIB had any initial feedback or would like to set up a meeting.
April 09, 2020	Chief, Natural Resource Department Director	Email – Outgoing	Team member provided the Chief of PIB with an update on the status of the WAR Feasibility Study further to the referral that went out on February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that PIB advise if they wish to participate in this field program.
April 23, 2020	Chief, Referrals Administrator	Email – Outgoing	Team member provided the Chief of PIB with an update further to the February 28, 2020 email. Team Member informed that the WAFS Report was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the feasibility study on March 31, 2020.
April 28, 2020	Chief, Natural Resource Department Director, Referrals	Email – Outgoing	Team member emailed representatives of PIB about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of

			the work, key dates, and attachments. Team member inquired whether PIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
May 10, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from PIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether PIB was interested and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if PIB was interested in someone joining the crews to let her know by May 22, 2020.
May 29, 2020	Chief	Email – Outgoing	Team member emailed Chief of PIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to PIB and TM would like to understand PIB's position on a potential alternative route. Team member mentioned that TM wrote to seek PIB's input on the WAR but had not received any comments. Team member stated that TM looked forward to receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be

			made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB and informed that Triton would like to invite a representative from PIB to participate in field studies for the WAR in early July 2020. Team member advised that the field work would be three days long and consist of fish and fish habitat assessments along the proposed alternate pipeline route. Team member advised the crew would consist of two Triton employees plus a participant from Esh-kn-am and potentially other participants from interested communities. Team member requested that if the Chief was able to find a participant to join the aquatics crew, to let her know by June 15, 2020 to allow time for planning. Team member advised that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of PIB a status update on TM’s engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB’s position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER’s consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of PIB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team member provided a link to access a copy of the letter on the CER’s website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up with the Chief of PIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the

			Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 27, 2020	Chief	Voicemail – Outgoing	Team member left a voicemail for the Chief of PIB noting she was calling about the WAR and was looking to understand PIB's position. Team member noted that the Chief may have heard about it through the Chief of UNB. Team member provided her contact information for follow-up.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of PIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of PIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked PIB to confirm its interest in participating by September 30, 2020.

Shackan Indian Band (SHIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed SHIB representatives a letter on consultation regarding the potential alternative route around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Executive Director	Email – Outgoing	Team member emailed Executive Director of SHIB and requested confirmation that SHIB received the information sent on February 28, 2020 from TM regarding consultation for the WAR. Team member requested SHIB to advise if they had any questions or wanted to meet for further discussion.
March 18, 2020	Executive Director	Email – Incoming	Executive Director of SHIB emailed Team member and confirmed that SHIB received the information dated February 28, 2020 from TM regarding consultation for the WAR. SHIB noted that they would advise if they had any comments after their review.
April 09, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed SHIB representatives stating the WAFS Report had been completed and submitted to CIB and the CER. Team member stated the opportunity to participate in field work was available and that engagement on the WAR remained open and did not end at the time of filing on March 31, 2020. Team member said to advise if SHIB was interested in participating in the upcoming field work.
April 23, 2020	Chief, Executive Director	Email – Outgoing	Team member provided SHIB representatives with an update further to the February 28, 2020 email. Team Member informed that the feasibility study for the WAR was complete and had been submitted to CIB and the CER. Team member advised that while the preliminary environmental field work was complete, TM had not completed archeological field work and a more detailed environmental field program may be required. Team member explained that, if TM ultimately decides to pursue the WAR for the Project, additional field work

			will be required and opportunities for Indigenous participation will be available. This means that engagement will not end at the time of filing of the feasibility study on March 31, 2020.
May 06, 2020	Chief, Executive Director	Email – Outgoing	Team member informed the Chief of SHIB of the completion and submission of the WAFS Report and provided a link to where it could be found. Team member requested that SHIB advise if they wish to participate in the field program.
May 08, 2020	Executive Director	Email – Outgoing	Team member emailed the Executive Director of SHIB and advised of a borehole investigation to be conducted by BGC Engineering on behalf of TM along the WAR. Team member noted that the investigation would involve HDD and provided information on how the work be executed. Team member informed the work would be conducted from May 4 – May 17, 2020 and listed the activities to take place on specific dates. Team member provided BGC's execution plan, shapefiles for the two boreholes sites, and a PDF map of the borehole locations. Team member requested that SHIB contact him should they be interested in monitoring the work.
May 10, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed Chief of SHIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from SHIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether SHIB was interested, and that fieldwork requirements could be discussed by phone or email.
May 12, 2020	Executive Director	Email – Outgoing	Team member emailed the Executive Director of SHIB and inquired if they required any further information regarding the WAR field studies. Team member requested that SHIB Executive Director contact him before the kick-off meeting on May 25, 2020 to confirm whether SHIB wished to participate in the study.

May 14, 2020	Senior Research and Referrals Analyst (of STC), Executive Director, Referrals Coordinator (of STC), Executive Director (of SHIB)	Email – Incoming	Senior Research and Referrals Analyst of STC copied Team member on an email to the Executive Director of SHIB and advised that STC would have an individual available to join the crew for the WAR biophysical field survey. STC informed Team member that STC participated with Jacobs on the field study in 2019.
May 14, 2020	Receptionist, Senior Research and Referrals Analyst (of STC)	Email – Exchange	Team member exchanged email with STC representative and confirmed that TM invited a member from STC at the May 25, 2020 WAR field studies kick-off meeting.
May 15, 2020	Senior Research and Referrals Analyst (of STC), Executive Director, Referrals Coordinator (of STC), Executive Director of SHIB	Email – Outgoing	Team member emailed Senior Research and Referrals Analyst, STC and advised the necessary information required to be set up with Jacobs. Team member noted the information needed as well as the schedule and activities for the WAR biophysical field study.
May 21, 2020	Senior Research and Referrals Analyst (of STC), Executive Director, Referrals Coordinator (of STC), Executive Director of SHIB	Email – Outgoing	Team member emailed the Senior Research and Referrals Analyst of STC and provided the rescheduled dates for the WAR biophysical field study and inquired if their rates for 2020 were the same as 2019.
May 21, 2020	Senior Research and Referrals Analyst (of STC), Executive Director, Referrals Coordinator (of STC)	Email – Incoming	Senior Research and Referrals Analyst of STC emailed Team member and provided their rate information for the WAR field work.
May 25, 2020	Senior Research and Referrals Analyst (of	Email – Outgoing	Team member emailed STC representatives and acknowledged receipt of the information regarding their rates. Team member informed that the soils and

	STC), Executive Director, Referrals Coordinator (of STC)		OGMA field work for the WAR biophysical study was postponed and tentatively rescheduled for early July 2020. Team member noted the dates for June and July 2020 regarding the vegetation, wetlands, weeds and wildlife.
May 27, 2020	Study participant	Email – Outgoing	Team member emailed SHIB study participant and introduced herself and noted that she would be helping to coordinate the safety and training requirements for the upcoming Coldwater biophysical work on the Project. Team member listed the dates, orientations and safety requirements, and informed the requirements would take up to three days to complete. Team member requested to send her a copy of completed Certificates.
May 29, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed the Chief of SHIB and requested feedback on the impact that the WAR would have on the community. Team member advised that TM was in discussions with CIB to seek consensus on a route through the Coldwater Valley. Team member advised that the two route options were the approved Eastern Route and the WAR. Team member noted that further to the letter sent to SHIB on February 28, 2020, TM had not received any comments from SHIB regarding the potential WAR and how it would impact the community. Team member advised that the WAFS Report had been filed with the CER and provided the weblink to the report. Team member requested that SHIB provide their comments by June 15, 2020 as a decision on the route would be made in the Summer 2020. Team member noted that TM could organize a video presentation on the WAR and that SHIB contact Team member with any questions they may have.
May 29, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed the Chief of SHIB and provided the shapefiles for the WAR. Team member noted that unlike the files that were shown to SHIB earlier, these shapefiles had a feature that allowed for the user to zoom in on specific areas.
June 04, 2020	Study participant	Email – Outgoing	Team member emailed SHIB study participant and informed that she would be helping to coordinate the safety and training requirements for the upcoming biophysical surveys on the WAR. Team member provided the dates, orientations and safety requirements. Team member requested that they complete the TM orientation and to send her a copy of the four documents and the one information request as soon as possible.

June 04, 2020	Senior Research and Referrals Analyst (of STC), Study participant, Eshknam CRMS Archaeology (Esh-Kn-Am Cultural Resources Management Services)	Email – Incoming	The Senior Research and Referrals Analyst of STC emailed Team member and informed that for the vegetation studies, SHIB participant would be driving with Esh-kn-am, and that social distancing measures would be followed.
June 09, 2020	Study participant	Email - Exchange	Team member exchanged email with SHIB participant, about Biosecurity details for biophysical fieldwork regarding the WAR.
June 10, 2020	Study participant	Phone call - Outgoing	Team member phoned SHIB study participant and discussed orientation planning details for biophysical fieldwork regarding the WAR.
June 10, 2020	Study participant	Email - Exchange	Team member exchanged email with SHIB study participant, about the orientation meeting for biophysical fieldwork regarding the WAR.
July 07, 2020	Executive Director (of STC), Representatives	Letter – Incoming	STC Executive Director emailed Team member a letter on behalf of SHIB and NHIB regarding the WAR and the HDD on the borehole locations BGC20-CW6-01 and BGC20-CW6-01-02. The letter dated July 6, 2020, advised that STC's research group, Tmix Research, had identified multiple sites of cultural value located in both borehole locations that infringed upon CSA. The letter noted that Tmix Research would require a CSA assessment and preliminary field reconnaissance. The letter advised that Tmix Research recognized that Coldwater Indian Reserve No. 2 (Paul's Basin) was adjacent to and impacted the proposed drilling work. The letter noted that Tmix Research would support the decision made by CIB and wished to ensure CIB's involvement prior to any work being conducted.
August 04, 2020	Executive Director (of STC)	Letter – Outgoing	Team member emailed the Executive Director of STC a response letter regarding the geotechnical investigation on the two geotechnical boreholes (BH1&2). The letter advised that both borehole drills were located on private lands and that TM had indicated in notifications, sent via email, that both drills were to be completed by May 18, 2020 and that the drilling programs had been completed. The letter provided a summary of borehole related activities. The

			letter advised that any questions or concerns be directed to their Indigenous Relations Advisor.
August 06, 2020	Chief, Executive Director	Letter – Outgoing	Team member emailed the Chief of SHIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed the Chief of SHIB seeking to confirm receipt of the email and letter sent by Team member on August 6, 2020. Team member offered his availability if there were any questions.
August 07, 2020	Chief, Executive Director	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to SHIB representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief, Executive Director	Letter – Outgoing	Team member followed up with the Chief of SHIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
August 26, 2020	Executive Director	Email – Outgoing	Team member emailed the Executive Director of SHIB referencing the recent correspondence from TM inquiring the position held by SHIB with regard to the

			WAR option. Team member stated he was available to answer any questions on the subject.
September 02, 2020	Executive Director	Email – Exchange	Team member emailed the Executive Director of SHIB and inquired if they would be sending in the draft support letter sent to SHIB on August 6, 2020. Team member offered his availability for a call if there were any questions or if SHIB would like to discuss. SHIB Executive Director requested for TM to resend the letter. Team member resent August 6, 2020 letter to SHIB.
September 04, 2020	Executive Director	Email – Incoming	The Executive Director of SHIB emailed Team member a support letter signed by the Chief for the WAR in the format of the template support letter sent on August 6, 2020. SHIB confirmed it supports Coldwater's pursuit of the West Alternative route for the Project and its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the WAR, including engaging in applicable consultation processes and other discussions with TM as may be required.
September 09, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed the Chief of SHIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief, Executive Director	Email – Outgoing	Team member emailed the Chief of SHIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of SHIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated

			that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked SHIB to confirm its interest in participating by September 30, 2020.

Siska Indian Band (SAIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief, Councillor, Lands Manager	Email – Outgoing	Team member emailed SAIB representatives a letter on consultation regarding the potential WAR around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SAIB and followed up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member asked if SAIB had any initial feedback or would like to set up a meeting.
April 28, 2020	Chief, Lands Manager	Email – Outgoing	Team member emailed the Chief of SAIB and Lands Manager about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether SAIB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM’s efforts to protect communities and workers in light of COVID-19
May 10, 2020	Chief, Lands Manager	Email – Outgoing	Team member emailed the Chief of SAIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from SAIB to join as a crew

			member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether SAIB was interested, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SAIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if SAIB was interested in someone joining the crews to let her know by May 22, 2020.
May 29, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SAIB and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to SAIB and TM would like to understand SAIB's position on a potential alternative route. Team member mentioned that TM wrote to seek SAIB's input on the WAR and did not receive comments. Team member stated that TM looked forward to receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 02, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SAIB and introduced herself as an Aquatics/Fisheries Biologist for Triton Environmental. Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member informed that Triton would like to invite a representative from SAIB or alternatively through STC to join Triton's field crew. Team member advised that the aquatics field program would consist of fish and fish habitat assessments at potential watercourse crossings along the proposed

			alternative pipeline route in early July 2020. The assessments would be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member requested that if the Chief was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
July 29, 2020	Legal Counsel	Email - Incoming	Legal counsel for SAIB emailed Team member regarding the Ministry of Transportation and Infrastructure (MoTI) - Wave 6 Referral information. Legal counsel inquired if the WAR option was separate from the MoTI - Wave 6 consultation.
July 30, 2020	Legal Counsel, Lands Manager	Email – Outgoing	Team member emailed SAIB representatives and advised that the WAR option was a different consultation process from the Ministry of Transportation and Infrastructure (MoTI) - Wave 6 Referral and would involve separate permitting requirements. Team Member inquired if SAIB had any concerns with the WAR should the Project need to move forward with that route. Team member indicated she was available to discuss at SAIB's convenience.
August 06, 2020	Chief, Lands Manager	Letter – Outgoing	Team member emailed the Chief of SAIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Voicemail – Outgoing	Team member called and left a message for the Chief of SAIB and asked for a call back or indication of any concerns with the proposed WAR. Team member left call back number.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to SAIB representatives. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team member

			advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 12, 2020	Legal Counsel, Lands Manager	Email – Incoming	SAIB suggested the parties schedule a meeting to discuss the accommodations that TM was willing to provide SAIB.
August 19, 2020	Legal Counsel, Lands Manager	Email – Outgoing	Team member emailed SAIB representatives and provided clarification around questions previously asked regarding the WAR. Team member provided a response to SAIB Legal Counsel's request to negotiate an agreement.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up with the Chief of SAIB on the letter of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SAIB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of SAIB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of SAIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and

			accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked SAIB to confirm its interest in participating by September 30, 2020.
September 28, 2020	Legal Counsel, Chief	Letter – Incoming	The Legal Counsel of SAIB emailed a letter of support to Team member stating SAIB supported CIB's pursuit of the WAR. SAIB confirmed it supports Coldwater's pursuit of the West Alternative route for the Project and its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the WAR, including engaging in applicable consultation processes and other discussions with TM as may be required.
October 1, 2020	Legal Counsel, Chief	Email – Exchange	The Legal Counsel of SAIB emailed Team member inquiring about availability for an online information meeting on October 4, 2020 at 1:00 pm or any evening during the upcoming week. Team member responded stating availability for either option and asked if the meeting topics would include the TMEP and the WAR.

Upper Nicola Band (UNB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB a letter on consultation regarding the potential alternative route around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
February 28, 2020	Referrals Coordinator, Cultural Heritage Resource Manager, Councillor	Email – Incoming	UNB representatives forwarded the email and letter titled, Consultation Regarding Potential WAR, from Team member to colleagues for review.
March 09, 2020	Referrals Coordinator, Cultural Heritage Resource Manager	Email – Outgoing	Team member emailed UNB representatives and followed up regarding its invitation for feedback on the alternative routing in the Coldwater area. Team member asked if UNB had any initial feedback or would like to set up a meeting.
April 9, 2020	Referrals Coordinator, Cultural Heritage Resource Manager, Cultural Heritage Project Manager,	Email – Outgoing	Team member provided UNB representatives with an update on the status of the WAFS further to the referral of February 28, 2020 and explained that consultation on the WAR would be ongoing. Team member stated that a more detailed environmental field program may be required in the spring and requested that UNB advise if they wish to participate in this field program.

	Councillor		
April 28, 2020	Councillor, Cultural Heritage Project Manager	Email – Outgoing	Team member emailed UNB representatives about the WAR and two related boreholes scheduled for drilling in May 2020. Team member explained that the purpose of the geotechnical investigation was to assess the feasibility of implementing a trenchless crossing of the Coldwater River near Merritt, BC using HDD for the proposed alternative route. Team member provided a description of the work, key dates, and attachments. Team member inquired whether UNB was interested in monitoring the work. Team member noted that TM may not be able to accommodate all monitoring requests due to on-site safety requirements, and the number of Indigenous groups impacted, but would work to accommodate any requests. Team member also provided a link regarding TM's efforts to protect communities and workers in light of COVID-19.
April 29, 2020	Councillor, Cultural Heritage Project Manager	Email - Incoming	UNB representatives emailed Team member and inquired about the upcoming HDD assessment work and the need for a monitor. UNB inquired about the minimum requirements for a monitor and whether it was at the same level as the Indigenous Monitor positions working at Kingsvale. UNB also inquired whether the monitor was required to do the online training, and if they could drive their own vehicle to the worksite. UNB stated they were interested in participating, but were operating at limited capacity, due to the COVID-19 situation.
April 30, 2020	Councillor, Cultural Heritage Project Manager	Email – Outgoing	Team member emailed UNB representatives and informed them that the monitor for the HDD work would be separate from the regular Indigenous Monitor position and would not require the same training prior to coming onto site. Team member noted she was connecting UNB with her colleagues who were coordinating the monitoring on site.
May 10, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from UNB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-inclusive list of safety measures that would be applied to the

			scope of work. Team member inquired whether UNB was interested, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if UNB was interested in a community member joining the crews to advise by May 22, 2020.
May 29, 2020	Chief, Councillor	Email – Outgoing	Team member emailed the Chief of UNB and Councillor and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to UNB and TM would like to understand UNB's position on a potential alternative route. Team member mentioned that TM wrote to seek Tunb's input on the WAR and did not receive comments. Team member stated that TM looked forward to receiving comments now that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 2, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB and introduced herself as an Aquatics/Fisheries Biologist for Triton Environmental. Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member informed that Triton would like to invite a representative from UNB or alternatively through STC to join Triton's field crew. Team member advised that the aquatics field program would consist of fish and fish habitat assessments at potential watercourse crossings along the proposed alternative pipeline route in early July 2020. The assessments would be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member requested that if the Chief was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.

June 5, 2020	Chief of UNB, Chief of CIB	Letter – Incoming	The Chief of UNB emailed Team member and provided a letter of support for the Chief of CIB and the work he was doing for his community. The letter stated that UNB had reviewed the WAFS Report and worked with TM to address any concerns that emerged in the desktop review, including monitoring borehole drilling. The letter concluded that UNB offered unconditional support to CIB and the proposed WAR.
June 5, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB and thanked him for the letter noting unconditional support of the WAR.
July 22, 2020	Chief	Email – Outgoing	Team member emailed Chief of UNB and inquired whether the support letter for the WAR was specific to just UNB, or if it represented any more Okanagan Nation Alliance groups more broadly.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of UNB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Voicemail – Outgoing	Team member left a voicemail for the Chief of UNB and requested a return call to discuss the WAR, whether the Chief had spoken or heard from any other Okanagan Nation Alliance (ONA) Chiefs.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of UNB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website. Team Member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 11, 2020	Cultural Heritage Project Manager	Phone call – Incoming	UNB Cultural Heritage Project Manager phoned Team member and discussed the archaeological fieldwork occurring south of Kamloops and on the WAR.

August 20, 2020	Chief	Letter – Outgoing	Team member followed up with the Chief of UNB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work toward consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, confirming the TM Indigenous Relations Advisor's availability to respond to any questions.
September 09, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Chief	Email – Outgoing	Team member emailed the Chief of UNB seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in Trans Mountain's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of UNB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided. Triton asked UNB to confirm its interest in participating by September 30, 2020.
September 17, 2020	Cultural Heritage Project Manager	Email – Incoming	UNB Cultural Heritage Project Manager requested a phone call with Team member to clarify details of the upcoming site visit to assess mitigation measures

			against impacts to fish and fish habitat. UNB representative posed the following questions and comments to Team member: • Will DFO and/or IAMC monitors would be involved in the site visit? • How can UNB be assured that this assessment will be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are avoided? • UNB along with other First Nations have significant concerns regarding DPI crossing under the Coldwater River, protection of spawning habitat and with the current drought conditions on Coldwater and Nicola Rivers. UNB representative said to inform her of what time worked best for a call to discuss.
September 20, 2020	Cultural Heritage Project Manager	Email – Incoming	UNB Cultural Heritage Project Manager emailed Team member requesting a response to her September 17, 2020 email.
September 22, 2020	Cultural Heritage Project Manager	Email – Outgoing	Team member emailed UNB Cultural Heritage Project Manager in response to her September 17, 2020 inquiries stating that the purpose of the site visit would be to facilitate an assessment of the contemplated crossing location of the Coldwater River for the WAR by an aquatics specialist. Team member stated the one-day site visit would include participation of representatives from potentially affected Indigenous groups and is intended to provide additional knowledge of the crossing site. Team member stated that neither DFO nor IAMC monitors would be involved in the site visit as they are not required for a pre-construction baseline site assessment. Team member said the results of the assessment by the aquatics specialist and any related construction and mitigation information would be presented to the Commission for its review and approval. Team member stated that TM does not intend to perform any in-stream work other than a bridge installation, and plans to utilize a trenchless method for pipe installation that will not impact spawning habitat. The work will take place in 2021 should Trans Mountain pursue the WAR and if approved by the Commission. Team member stated Trans Mountain would like to better understand UNB's concerns with the DPI crossing and how Trans Mountain can resolve those concerns.

September 22, 2020	Cultural Heritage Project Manager	Email – Incoming	UNB Cultural Heritage Project Manager emailed Team member thanking her responding to her inquiries and confirmed UNB participation in the upcoming site visit assessment.
September 29, 2020	Cultural Heritage Project Manager	Email – Exchange	Triton emailed the UNB Cultural Heritage Project Manager noting that the site visit assessment scheduled for October 7, 2020 would be postponed. UNB Cultural Heritage Project Manager responded in acknowledgement.

Upper Similkameen First Nation (USIB)

Date	Community contacts	Method	Communication
February 28, 2020	Chief	Email – Outgoing	Team member emailed USIB representatives a letter on consultation regarding the potential alternative route around The Coldwater Reserve, referred to as the WAR. The letter stated that TM was engaging with CIB on this routing option. The letter enclosed a map for reference and requested input regarding the potential route for the feasibility study by March 20, 2020, as the study would be filed with the CER by March 31, 2020. The letter directed any questions or concerns to their Indigenous Relations Advisor whose contact information was provided.
March 4, 2020	Referrals Administrator	Email - Incoming	Referrals Administrator for USIB emailed Team member and provided a letter, not dated, regarding the WAR. The letter stated that after a desktop review by the Natural Resources Department, it was determined that the referral fell outside of USIB's area of responsibility and included an updated map for TM.
March 9, 2020	Referrals Administrator	Email – Outgoing	Team member emailed USIB Referrals Administrator and followed up regarding its invitation for feedback on our alternative routing in the Coldwater area. Team member inquired if USIB had any initial feedback or would like to set up a meeting.
April 14, 2020	Referrals Administrator	Email – Outgoing	Team member emailed USIB Referrals Administrator and provided links to explanations of how TM was maintaining safe operations of the existing pipeline and how they were approaching construction in regards to COVID-19 and the new construction schedule filed with the CER. Team member also provided an update on the status of the WAR and noted the WAFS Report was completed and had been submitted to CIB and the CER. Team member mentioned additional field work might be required and opportunities for Indigenous participation would be available and to advise TM as soon as possible if USIB was interested to participate in upcoming field work. Team member mentioned if there was anything TM could do during this time to make communication easier or more efficient for USIB, such as send previous or future referral packages to a home address for safety reasons.

April 16, 2020	Referrals Administrator	Email - Incoming	USIB Referrals Administrator emailed Team member and informed that USIB's office closed on March 16, 2020 due to COVID-19 and would remain closed indefinitely. USIB had completed a desktop review of the referral and advised the referral was not within USIB's Area of Interest. USIB suggested they would defer to CIB and their neighbouring First Nation communities. USIB expressed appreciation for TM's engagement and would like to be notified of any upcoming route changes that were closer to USIB Area of Interest such as the Aspen Grove area.
May 10, 2020	Chief	Email – Outgoing	Team member emailed the Chief of USIB and advised that there was a biophysical field study scheduled for June 2020 on the WAR near Merritt, BC. Team member extended an invitation to one representative from USIB to join as a crew member. Team member informed that both TM and Jacobs had additional COVID-19 safety precautions in place to maintain a safe work environment and ensure the safe operation of the pipeline construction and maintenance activities. Team member stated the fieldwork was expected to last approximately 2-3 weeks with targeted locations across the route to conduct wildlife, vegetation, wetlands, soils and related studies. Team member provided an additional non-exhaustive list of safety measures that would be applied to the scope of work. Team member inquired whether USIB was interested in participating, and that fieldwork requirements could be discussed by phone or email.
May 19, 2020	Chief	Email – Outgoing	Team member emailed the Chief of USIB and provided a description of the field work for the WAR biophysical study occurring June 8 - July 3, 2020. Team member noted that if USIB was interested in a community member joining the crews to let her know by May 22, 2020.
May 29, 2020	Chief, Referrals Administrator	Email – Outgoing	Team member emailed USIB representatives and stated that on April 15, 2020, TM filed the WAFS Report with the CER, which confirmed that a WAR was a technically feasible route option. Team member provided a map identifying the most practical WAR option and a map of TM's approved (Eastern) route. Team member mentioned the routing determinations through the Coldwater Valley might be of interest to USIB and TM would like to understand USIB's position on a potential alternative route. Team member mentioned that TM wrote to seek USIB's input on the WAR but had not received any comments. Team member stated that TM looked forward to receiving comments now

			that the WAFS Report had been filed. Team member expressed that TM would be pleased to organize a presentation by video or teleconference and/or answer any questions regarding the WAR. Team member advised that TM's routing determination would be made in the summer of 2020, and therefore requested a response at the earliest convenience or by June 15, 2020.
June 2, 2020	Chief	Email – Outgoing	Team member emailed the Chief of USIB and introduced herself as an Aquatics/Fisheries Biologist for Triton Environmental. Team member informed that Triton was planning a three-day aquatics field program in July 2020 on the proposed WAR. Team member informed that Triton would like to invite a representative from USIB to join Triton's field crew. Team member advised that the aquatics field program would consist of fish and fish habitat assessments at potential watercourse crossings along the proposed alternative pipeline route. The assessments would be used to inform construction methods and mitigation to ensure impacts to fish and fish habitat were avoided. Team member requested that if the Chief was interested in having a participant join the aquatics crew, to let her know no later than June 15, 2020. Team member stated that TM had developed COVID-19 protocols to help ensure the safety of crew members during the field program.
August 06, 2020	Chief	Letter – Outgoing	Team member emailed the Chief of USIB a status update on TM's engagement on the WAR. Team member informed that TM had invited comments and feedback on the WAR, provided notice of and opportunities to participate in related fieldwork and offered to meet to discuss the WAR and any related issues. Team member attached a map of the proposed route as well as a letter template to canvas support for CIB's position on the WAR and requested that a formal response be provided by August 15, 2020. Team member explained that TM planned to file an application for the CER's consideration of the WAR no later than September 1, 2020. Team member explained that TM would follow up to seek a response and that the Chief of CIB welcomed any questions.
August 07, 2020	Chief	Letter – Outgoing	Team member emailed a Project Notification letter filed with the CER on July 29, 2020 to the Chief of UNB. The letter stated that TM was considering an application under section 190 of the CER Act to modify the TMEP Certificate (OC-065) to accommodate an alternate route in the Coldwater Valley. Team Member provided a link to access a copy of the letter on the CER's website.

			Team member advised that any questions or further clarification should be directed to their respective Indigenous Relations Advisor.
August 20, 2020	Chief	Letter – Outgoing	Team member followed up with the Chief of USIB on her email of August 7, 2020 and provided a copy of a letter TM filed with the CER on August 17, 2020. Team member relayed the contents of the letter stating that while TM and CIB continue to work towards consensus on the preferred route through the Coldwater Valley, the approved eastern alignment remains a viable option available for TM to ensure it achieves the Project's in-service date for its customers. Team member attached the letter and provided the CER link to where it was filed, stating their Indigenous Relations Advisor's availability to respond to any questions.
September 09, 2020	Reception, Referrals	Email – Outgoing	Team member emailed the USIB receptionist and referrals office noting that Trans Mountain was evaluating alternative trenchless methods to HDD in light of additional geotechnical drilling results and because of the challenging geotechnical conditions in the area. Team member provided a description of two methods being evaluated: DPI and Micro-tunnelling, noting that DPI is Trans Mountain's preferred method. Team member stated that both methods would take place about 500 m south of the originally proposed northern HDD crossing location and included a map. Team member offered their availability for a call to discuss further or answer any questions.
September 11, 2020	Reception, Referrals	Email – Outgoing	Team member emailed the USIB receptionist and referrals office seeking to confirm receipt of the September 9, 2020 email regarding the potential use of alternative crossing methods and the potential change in crossing location. Team member stated the alternative methods would be discussed in further detail in TM's application to the CER, which would be filed in the coming weeks. Team member offered their availability for a call to discuss further or answer any questions.
September 16, 2020	Chief	Email – Outgoing	An Aquatics and Fisheries Biologist from Triton emailed the Chief of USIB regarding an opportunity to participate in an upcoming one-day site visit and assessment of the proposed DPI crossing under the Coldwater River and accompanying proposed temporary workspaces and drag section. Triton stated that the assessment would be used to inform construction methods and mitigation measures to ensure impacts to fish and fish habitat are

			avoided. Triton asked USIB to confirm its interest in participating by September 30, 2020.
September 18, 2020	Referrals Administrator	Letter – Incoming	The USIB Referrals Administrator emailed Team member a letter of response stating that the proposed WAR falls outside the area of responsibility of the USIB and that they would defer to UNB and LNIB at this time. The Referrals Administrator stated that USIB is aware that a portion of the WAR is in USIB's area of interest and requested to continue being made aware of all developments as the TMEP moves forward.

Appendix C-2 Letters of Support for the Coldwater Variance Application from Indigenous Groups

Coldwater Indian Band

2249 Quilchena Avenue,
P.O. Box 4600 Stn Main Merritt, BC V1K 1B8
Phone (250) 378-6174 Fax (250) 378-5351

October 9, 2020 **Via Email (ian_anderson@transmountain.com)**

Trans Mountain Pipeline ULC
Suite 2700
300 – 5th Avenue SW
Calgary, AB T2P 5J2

Attn: Ian Anderson, President

Dear Mr. Anderson:

Re: West Alternative Variance Application

Coldwater Indian Band ("Coldwater") has consistently stated that the approved east corridor for the Trans Mountain Expansion Project ("TMEP") presents serious risks and would impose significant adverse impacts on the aquifer that is the only source of drinking water at Coldwater IR#1 (the "Aquifer") and that these risks and impacts should be avoided.

As you know, in recent months, we have discussed an alternative Western route for the TMEP, which would cross the Coldwater River and avoid IR#1 and the Aquifer (the "West Alternative").

Now, Trans Mountain has prepared an application to the Canada Energy Regulator to vary the corridor for TMEP to follow the West Alternative (the "Variance Application"), and Coldwater has reviewed and commented on the Variance Application.

On behalf of the elected Coldwater Council, we confirm that Council:

- confirms that the proposed West Alternative would address Coldwater's concerns regarding potential impacts from the TMEP on the Aquifer; and
- subject to further engagement with the Coldwater community, supports the proposed West Alternative and the Variance Application.

Sincerely,

Chief Lee Spahan

Vice Chief Larry Antoine

MISSION STATEMENT

To enhance and sustain our quality of life through wellness and culture, and to utilize and preserve all our resources for now and future generations.

Boston Bar First Nation

PO Box 369, Boston Bar BC, V0K 1C0
Phone: 604-867-8844 Fax: 604-867-9317
BBARBANDD@UNISERVE.COM

September 4, 2020

Trans Mountain Pipeline L.P.
Suite 2700, Stock Exchange Tower
300 – 5 Avenue S.W. Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President & CEO

Dear Mr. Anderson,

RE: West Alternative Route for the Trans Mountain Expansion Project

I am writing on behalf of **Boston Bar First Nation** in respect of the Trans Mountain Expansion Project (the Project).

I understand that Trans Mountain Pipeline L.P. (Trans Mountain) and Coldwater Indian Band (Coldwater) have been engaging in respect of the proposed West Alternative route for the Project, as shown in Appendix A to this letter (the West Alternative). I further understand that:

i. Coldwater supports pursuing the West Alternative;

ii. Trans Mountain has agreed with Coldwater to pursue the West Alternative as an alternative route for the Project, provided that Trans Mountain is fully satisfied with the results of its assessment of the West Alternative; and

iii. a key component of Trans Mountain's assessment is determining whether other First Nations potentially impacted by the West Alternative support pursuing this as a route alternative for the Project.

I wish to confirm, on behalf of **Boston Bar First Nation** that we support Coldwater's pursuit of the West Alternative route for the Project. To this end, **Boston Bar First Nation** confirms its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required. **[For clarity, this letter does not express or otherwise indicate Boston Bar First Nation support for the Project.**

Yours truly,

Dolores O'Donaghey

Chief Dolores O'Donaghey

cc. Chief Lee Spahan, Coldwater Indian Band

Cook's Ferry Indian Band
Nlaka'pamux Nation
3691 Deer Lane P.O. Box 130
Spences Bridge B.C V0K-2L0
Phone: (250) 458-2225 Fax (250) 458-2312
Email: christine.minnabarriet@cooksferry.ca

September 4, 2020

Trans Mountain Pipeline L.P.
Suite 2700, Stock Exchange Tower
300 – 5 Avenue S.W. Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President & CEO

Dear Mr. Anderson,

RE: West Alternative Route for the Trans Mountain Expansion Project

I am writing on behalf of Cook's Ferry Indian Band in respect of the Trans Mountain Expansion Project (the Project).

I understand that Trans Mountain Pipeline L.P. (Trans Mountain) and Coldwater Indian Band (Coldwater) have been engaging in respect of the proposed West Alternative route for the Project, as shown in Appendix A to this letter (the West Alternative). I further understand that:

i. Coldwater supports pursuing the West Alternative;

ii. Trans Mountain has agreed with Coldwater to pursue the West Alternative as an alternative route for the Project, provided that Trans Mountain is fully satisfied with the results of its assessment of the West Alternative; and

iii. a key component of Trans Mountain's assessment is determining whether other First Nations potentially impacted by the West Alternative support pursuing this as a route alternative for the Project.

I wish to confirm, on behalf of Cook's Ferry Indian Band, that we support Coldwater's position for clean drinking water as a basic human right and Coldwater's Indigenous right to self-determination. To this end, Cook's Ferry Indian Band confirms its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required. Cook's Ferry council has agreed to a referendum of participating eligible electors by the end of September 2020 to decide whether or not to support and approve the Pipeline Expansion.

Sincerely,

Christine Minnabarriet
Chief

Cc: Chief Lee Spahan, Coldwater Indian Band

Nooaitch Indian Band

2954 Shackelly Road
Merritt, B.C. VIK-1N9

Ph: 250-378-6141
Fax: 250-378-3699

August 12, 2020

Trans Mountain Pipeline L.P.
Suite 2700, Stock Exchange Tower
300 – 5 Avenue S.W. Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President & CEO

Dear Mr. Anderson,

RE: West Alternative Route for the Trans Mountain Expansion Project

I am writing on behalf of **Nooaitch Indian Band** in respect of the Trans Mountain Expansion Project (the Project).
I understand that Trans Mountain Pipeline L.P. (Trans Mountain) and Coldwater Indian Band (Coldwater) have been engaging in respect of the proposed West Alternative route for the Project, as shown in Appendix A to this letter (the West Alternative). I further understand that:

i. Coldwater supports pursuing the West Alternative;

ii. Trans Mountain has agreed with Coldwater to pursue the West Alternative as an alternative route for the Project, provided that Trans Mountain is fully satisfied with the results of its assessment of the West Alternative; and

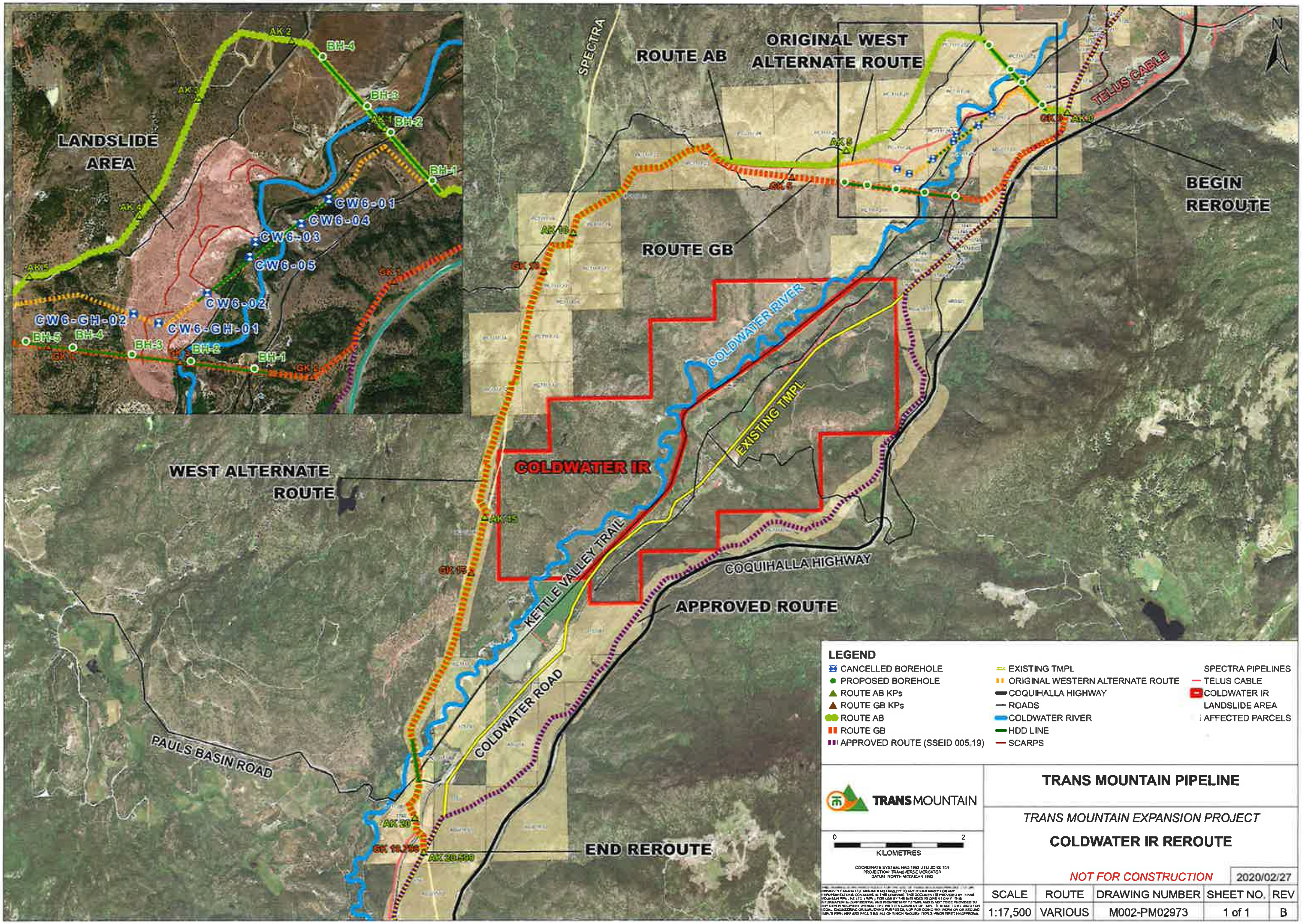
iii. a key component of Trans Mountain's assessment is determining whether other First Nations potentially impacted by the West Alternative support pursuing this as a route alternative for the Project.

I wish to confirm, on behalf of **Nooaitch Indian Band**, that we support Coldwater's pursuit of the West Alternative route for the Project. To this end, **Nooaitch Indian Band** confirms its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required.

Yours truly,

Chief Marcel Shackelly
Nooaitch Indian Band

cc. Chief Lee Spahan, Coldwater Indian Band



TRANS MOUNTAIN

COORDINATE SYSTEM: NAD 1983 UTM ZONE 10N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983

TRANS MOUNTAIN PIPELINE

TRANS MOUNTAIN EXPANSION PROJECT

COLDWATER IR REROUTE

NOT FOR CONSTRUCTION

2020/02/27

SCALE	ROUTE	DRAWING NUMBER	SHEET NO.	REV
1:17,500	VARIOUS	M002-PM02973	1 of 1	B

September 4, 2020

Trans Mountain Pipeline L.P.
Suite 2700, Stock Exchange Tower
300 – 5 Avenue S.W. Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President & CEO

Dear Mr. Anderson,

RE: West Alternative Route for the Trans Mountain Expansion Project

I am writing on behalf of **Shackan Indian Band** in respect of the Trans Mountain Expansion Project (the Project).

I understand that Trans Mountain Pipeline L.P. (Trans Mountain) and Coldwater Indian Band (Coldwater) have been engaging in respect of the proposed West Alternative route for the Project, as shown in Appendix A to this letter (the West Alternative). I further understand that:

i. Coldwater supports pursuing the West Alternative;

ii. Trans Mountain has agreed with Coldwater to pursue the West Alternative as an alternative route for the Project, provided that Trans Mountain is fully satisfied with the results of its assessment of the West Alternative; and

iii. a key component of Trans Mountain's assessment is determining whether other First Nations potentially impacted by the West Alternative support pursuing this as a route alternative for the Project.

I wish to confirm, on behalf of **Shackan Indian Band]**, that we support Coldwater's pursuit of the West Alternative route for the Project. To this end Shackan Indian Band confirms its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required.

Yours truly,

Chief Jordan Joe

cc. Chief Lee Spahan, Coldwater Indian Band

Siska Indian Band

Box 519
Lytton, BC
V0K 1Z0
Phone: 250-455-2219
Fax: 250-455-2539

September 25, 2020

Trans Mountain Pipeline L.P.
Suite 2700, Stock Exchange Tower
300-5 Avenue S.W. Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President & CEO

Dear Mr. Anderson,

RE: West Alternative Route for the Trans Mountain Expansion Project

I am writing on behalf of the Siska Indian Band in respect of the Trans Mountain Expansion Project (the Project).

I understand that Trans Mountain Pipeline L.P. (Trans Mountain) and Coldwater Indian Band (Coldwater) have been engaging in respect of the proposed West Alternative route for the Project, as shown in Appendix A to this letter (the "West Alternative"). I further understand that:

i. Coldwater supports pursuing the West Alternative;

ii. Trans Mountain has agreed with Coldwater to pursue the West Alternative as an alternative route for the Project, provided that Trans Mountain is fully satisfied with the results of its assessment of the West Alternative; and

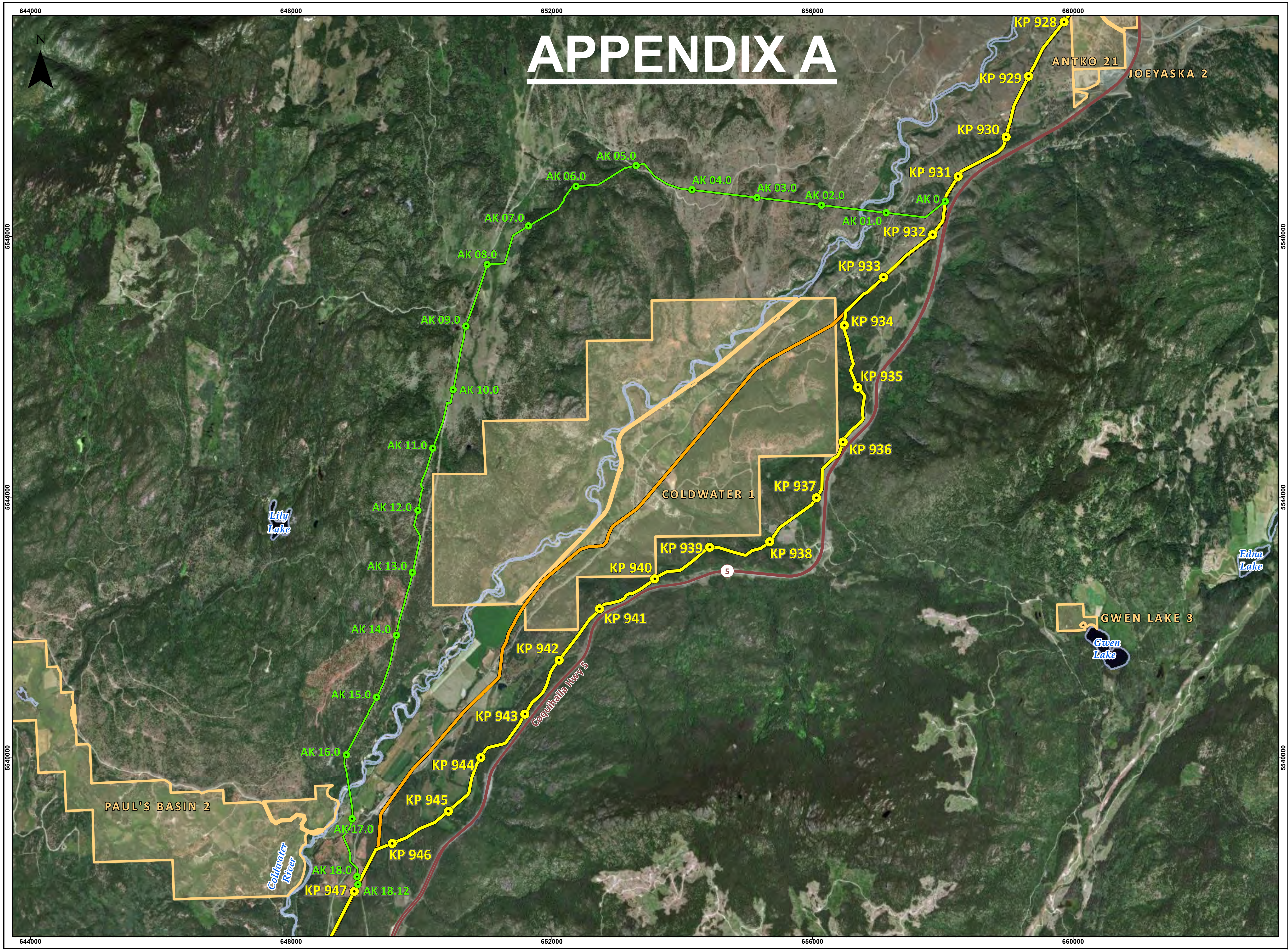
iii. a key component of Trans Mountain's assessment is determining whether other First Nations potentially impacted by the West Alternative support pursuing this as a route alternative for the Project.

I wish to confirm, on behalf of the Siska Indian Band, that we support Coldwater's pursuit of the West Alternative route for the Project. To this end, Siska Indian Band confirms its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required.

Yours Truly,

Chief Fred Sampson
cc. Chief Lee Spahan, Coldwater Indian Band

APPENDIX A



TRANS MOUNTAIN

● Coldwater Alternative Kilometre Post (KP)

● TMEP Pipeline Kilometre Post (KP)

— Coldwater West Alternative Pipeline Route

— TMEP Pipeline

— Existing TMPL Pipeline

—①— Highway

▭ Indian Reserve

▭ Hydrology

Projection: NAD 1983 UTM Zone 10N.
Coldwater West Alternative Centreline provided by UPI March 10, 2020; Pipeline SSEID005.19 Spread 5A and KPs provided by UPI December 10, 2018; TMPL Route Revision 0 provided by KMC, May 2012; Transportation: BC MFLNRO 2012; Hydrology: BC MFLNRO 2008; First Nation Lands: Government of Canada 2018; Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

This document is provided by Kinder Morgan Canada Inc. (KMC) for use by the intended recipient only. This information is confidential and proprietary to KMC and is not to be provided to any other recipient without the written consent of KMC. It is not to be used for legal, engineering or surveying purposes, nor for doing any work on or around KMC's pipelines and facilities, all of which require KMC's prior written approval.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

MAP NUMBER
202001_MAP_CH2M_GEN_01168_REV1

DATE March 2020	REFERENCE CE733700	REVISION 1
SCALE 1:55,000	PAGE SIZE 11x17	DISCIPLINE GEN
DRAWN SMZ	CHECKED DJN	DESIGN CMR

0 1 2 km

ALL LOCATIONS APPROXIMATE

202001_MAP_CH2M_GEN_01168_Rev1.mxd

SPUZZUM
FIRST NATION

Our Land. Our Future. Our Success. Forward Focused Nation Building.

36500 Main Road, Spuzzum, BC V0K 2S1
Office: 604-863-2395 / Fax: 604-863-2218
www.spuzzumnation.com

August 28, 2020

Trans Mountain Pipeline L.P.
Suite 2700, Stock Exchange Tower
300 – 5 Avenue S.W. Calgary, AB T2P 5J2

Attention: Ian D. Anderson, President & CEO

Dear Mr. Anderson,

RE: West Alternative Route for the Trans Mountain Expansion Project

I am writing on behalf of Spuzzum First Nation in respect of the Trans Mountain Expansion Project (the Project).

I understand that Trans Mountain Pipeline L.P. (Trans Mountain) and Coldwater Indian Band (Coldwater) have been engaging in respect of the proposed West Alternative route for the Project, as shown in Appendix A to this letter (the West Alternative). I further understand that:

i. Coldwater supports pursuing the West Alternative and we see Coldwater leading the indigenous engagement for the Project;

ii. Trans Mountain has agreed with Coldwater to pursue the West Alternative as an alternative route for the Project, provided that Trans Mountain is fully satisfied with the results of its assessment of the West Alternative; and

iii. a key component of Trans Mountain's assessment is determining whether other First Nations potentially impacted by the West Alternative support pursuing this as a route alternative for the Project.

I wish to confirm, on behalf of Spuzzum First Nation, that we support Coldwater's pursuit of the West Alternative route for the Project. To this end, Spuzzum First Nation confirms its desire to engage with Trans Mountain in a good faith and timely manner in order to advance the West Alternative, including engaging in applicable consultation processes and other discussions with Trans Mountain as may be required.

Yours truly,

Chief James Hobart

cc. Chief Lee Spahan, Coldwater Indian Band

SPUZZUM
FIRST NATION

Our Land. Our Future. Our Success. Forward Focused Nation Building.

36500 Main Road, Spuzzum, BC V0K 2S1
Office: 604-863-2395 / Fax: 604-863-2218
www.spuzzumnation.com

Appendix A
West Alternative

[See attached]

Upper Nicola

June 4th, 2020

Re: Western Alternative Feasibility Study Report (WAFS Report)

To whom it may concern:

Upper Nicola Band has reviewed the Western Alternative Feasibility Study Report and worked with TransMountain to address any concerns that emerged in the desktop review, including monitoring borehole drilling. We therefore offer UNB's unconditional support to Coldwater Indian Band and the proposed Western Alternative re-routing option to the west of Coldwater IR #1.

Sincerely,

Harvey McLeod

Chief Harvey McLeod

Cc. Coldwater Indian Band – Chief Lee Spahan
Okanagan Indian Band - Chief Byron Louis
Upper Similkameen Band – Chief Bonnie Jacobson
Lower Similkameen Band – Chief Keith Crow
Council - Upper Nicola Band
Lindsay Carnes - Advisor, Indigenous Relations

PO Box 3700 Merritt, BC V1K 1B8 T 250.350.3342 F 250.350.3311 www.uppernicola.com

Appendix D Approach to CER Condition Compliance

Appendix D

Trans Mountain's Proposed Approach to Addressing TMEP Pre-Construction Conditions to Reflect the West Alternative

Trans Mountain will provide stand-alone updates where required to address pre-construction condition compliance. The environmental conditions will be addressed through environmental alignment sheets (EAS), resource-specific mitigation tables (RSMTs) and updates to the mitigation measures consolidated in Appendix G of the Pipeline EPP.

#	Condition Name	Proposed Change to Condition	Proposed Change or Update to Condition Compliance Filings	Rationale
Engineering, Design and Risk Assessment Conditions				
15	Pipeline risk assessment	None	Update quantitative risk assessment results to reflect West Alternative alignment and associated risk parameters.	The current risk assessment includes geotechnical risks and high consequence areas specific to the approved TMEP alignment (including the East Route). The condition compliance filing will be updated to reflect the West Alternative and related risk parameters as part of this Variance Application process (see paragraph 14 (j) of the main Variance Application document).Therefore, should the Variance Application be approved and unless the Commission otherwise directs, Trans Mountain's Condition 15 filing should be considered to be updated and accepted by the CER with the pipeline risk assessment filed in support of the Variance Application.
16	Quantitative geohazard frequency assessment	None	Provide a supplemental quantitative geohazard frequency assessment specific to the West Alternative and associated geohazards.	There are geohazards present along the West Alternative that are not considered in the current geohazard assessment.
17	Valve locations on Line 2	None	Provide a supplemental report specific to the Line 2 valve locations along the West Alternative.	The current valve location assessment does not account for the West Alternative. The supplemental report will address all requirements of Condition 17 for the West Alternative only.
39	Hydrogeological study at Coldwater	Remove Condition 39	N/A	The purpose of Condition 39 was to address Coldwater's concerns regarding contamination risks posed by the East Route to the aquifer

#	Condition Name	Proposed Change to Condition	Proposed Change or Update to Condition Compliance Filings	Rationale
	Indian Reserve (IR) No. 1			beneath the Reserve. The proposed West Alternative addresses Coldwater's concerns with respect to potential risks to the aquifer, and, therefore, Condition 39 would no longer be required if the Commission approves the Variance Application. Trans Mountain has communicated its intention to seek removal of Condition 39 from the Certificate as part of the Variance Application to Coldwater.
66	Risk Management Plan for geohazards	None	Provide a supplemental risk management plan specific to known geohazards along the West Alternative route.	The current risk management plan for geohazards does not include known geohazards along the West Alternative.
67	Outstanding horizontal directional drilling geotechnical and feasibility reports	None	Provide all outstanding geotechnical reports and trenchless feasibility and design reports, along with final design drawings, for each of: a) West Alternative Coldwater River Crossing #1a; and b) West Alternative Coldwater River Crossing #2; pursuant to paragraph (g) of Condition 67.	Detailed geotechnical and feasibility reports and/or design drawings for these trenchless crossings of the Coldwater River are not currently available. Trans Mountain will provide these reports and drawings to the Commission pursuant to the timing required by Condition 67, as it has done previously for other trenchless river crossings where geotechnical information was not available at the time the Certificate was issued (e.g., Salmon River, Thompson River, Coldwater River #2).
103	Utility crossings	None	Provide a list of all underground utilities to be crossed by the Project and associated information required by Condition 103 (included herein).	All information required by Condition 103 related to the West Alternative has been included with this Variance Application. Therefore, should the Variance Application be approved, Trans Mountain's Condition 103 filing should be considered to be updated with the utility crossing information included herein.
Environmental and Impact Mitigation Conditions				
40-42, 44-45, 47, 71, 76	Rare Ecological Community and Rare Plant Population Management Plan // Wetland Survey and Mitigation Plan // Grasslands Survey and Mitigation Plan //	None	None	There is no need to update the Plans themselves, as none of the environmental features require new mitigation that is not currently included in the Plans. The inclusion of site-specific features on the West Alternative will be addressed through updates to the

#	Condition Name	Proposed Change to Condition	Proposed Change or Update to Condition Compliance Filings	Rationale
	Wildlife Species at Risk Mitigation and Habitat Restoration Plans // Weed and Vegetation Management Plan // Access Management Plan(s) // Riparian Habitat Management Plan // Old Growth Management Areas Mitigation and Replacement Plan			environmental alignment sheets (“EASs”) and resource-specific mitigation tables (“RSMTs”) (see below).
43	Watercourse crossing inventory	None	Rely on information in the Aquatics TDR enclosed with the West Alternative ESA to provide an update to Condition 43 on a spread-specific basis.	All information required by Condition 43 related to the West Alternative has been included with this Variance Application. Therefore, should the Variance Application be approved, Trans Mountain’s Condition 43 filing should be considered to be updated with the watercourse crossing information included herein.
72	Pipeline Environmental Protection Plan	None	Provide updated EASs and RSMTs for the West Alternative.	The EASs and RSMTs are the key site-specific components of the Project environmental protection plans. New EASs and RSMTs reflecting the West Alternative and associated site-specific mitigation measures are required and will be filed prior to construction.
73	Traffic Control Plans for public roadways	None	Provide a supplemental traffic control plan specific to the West Alternative.	Construction along the West Alternative will require changes to Trans Mountain’s access routes for construction traffic. Trans Mountain will prepare site-specific traffic control measures to support construction access along the West Alternative.
74	Horizontal directional drilling (HDD) Noise Management Plan	None	Provide site-specific noise management plans for the West Alternative Coldwater River Crossings (#1a and #2).	There is one HDD and one DPI section along the West Alternative that have not previously been included in Condition 74 noise management plans for the TMEP.
89	Emergency Response Plans for construction	None	Provide a site-specific Emergency Response Plan for construction related to the West Alternative.	While the TMEP Emergency Response Plan remains unchanged, a further site-specific emergency response plan is required for the West Alternative.

#	Condition Name	Proposed Change to Condition	Proposed Change or Update to Condition Compliance Filings	Rationale
93	Water well inventory	None	Provide a supplemental water well inventory specific to water wells within 150 m of the West Alternative route.	The current water well inventory does not include water wells along the West Alternative.
100	Heritage Resources and Sacred and Cultural Sites	None	Provide a compliance filing pursuant to Condition 100 in relation to the West Alternative.	Trans Mountain will obtain the necessary archaeological and heritage resource permits from the British Columbia Ministry of Forests, Lands and Natural Resource Operations prior to commencing construction along the West Alternative and will file related information required by Condition 100 with the Commission, subject to confidentiality requirements.

APPENDIX D

TRANS MOUNTAIN'S PROPOSED APPROACH TO ADDRESSING TMEP EAC CONDITIONS TO REFLECT THE WEST ALTERNATIVE ROUTE

APPENDIX D

TRANS MOUNTAIN'S PROPOSED APPROACH TO ADDRESSING TRANS MOUNTAIN EXPANSION PROJECT ENVIRONMENTAL ASSESSMENT CERTIFICATE CONDITIONS TO REFLECT THE WEST ALTERNATIVE ROUTE

Trans Mountain Pipeline ULC (Trans Mountain) will provide stand-alone updates where required to address pre-construction Condition compliance.

#	Condition Name	Proposed Change to Condition	Proposed Change or Update to Condition Compliance Filings	Rationale
Pre-Construction Conditions Previously Satisfied				
10	Aboriginal Consultation Report	None	None	A detailed Indigenous engagement summary related to the West Alternative is included in the Canada Energy Regulator (CER) s.190 Application materials contained in Appendix C of the Amendment Application.
14	Public Communications and Engagement	None	None	A detailed public communications and engagement summary is included in the CER s.190 Application materials contained in Appendix C of the Amendment Application.
16, 17, 22	Wildlife Species at Risk Mitigation and Offset Plan (Condition 16); Weed and Vegetation Management Plan (Condition 17); Access Management Plan (Condition 22)	None	None	The mitigation measures outlined in the current Plans address the environmental features of the West Alternative. No further update to these Plans is required.
25	Coldwater Aquifer	Remove Condition 25	N/A	The purpose of Condition 25 was to address Coldwater Indian Band's concerns regarding contamination risks posed by the approved Trans Mountain Expansion Project (TMEP) alignment to the aquifer beneath the Coldwater Indian Reserve No.1 (Coldwater IR). The proposed West Alternative addresses Coldwater Indian Band's concerns with respect to potential risks to the aquifer, and, therefore, Condition 25 would no longer be required if the proposed amendment is approved. Trans Mountain is requesting the British Columbia Environmental Assessment Office (BC EAO) remove Condition 25 from the Certificate E17-01. As stated in the Variance Application for the West Alternative, Trans Mountain has communicated its intention to seek removal of CER Condition 39 (which is linked to Environmental Assessment Certificate [EAC] Condition 25) from the CER Certificate as part of the Variance Application to Coldwater Indian Band.
27	Archaeological – Heritage Resources	None	Provide a compliance filing pursuant to Condition 27 in relation to the West Alternative.	Trans Mountain will obtain the necessary archaeological and heritage resource permits from the British Columbia Ministry of Forests, Lands Natural Resource Operations and Rural Development prior to commencing construction along the West Alternative and will file related information required by Condition 27 with the BC EAO, subject to confidentiality requirements.

#	Condition Name	Proposed Change to Condition	Proposed Change or Update to Condition Compliance Filings	Rationale
30	Pipeline Design to Reduce Spill Risk	None	Update quantitative risk assessment results to reflect West Alternative alignment and associated risk parameters.	The current risk assessment includes geotechnical risks and high consequence areas specific to the approved TMEP alignment. The condition compliance filing will be updated to reflect the West Alternative and related risk parameters as part of the CER Variance Application process (see paragraph 14 (j) in the Part 1 of 3 of the CER Variance Application) (Filing ID C08844). Therefore, should the proposed amendment be approved and unless the BC EAO otherwise directs, Trans Mountain's Condition 30 filing should be considered to be updated and accepted by the BC EAO with the pipeline risk assessment filed in support of the Variance Application.
Pre-Construction Conditions Not Yet Satisfied				
28	Greenhouse Gas Reporting	None	Provide a compliance filing pursuant to Condition 28 in accordance with the timing outlined in the Certificate.	Trans Mountain will quantify and report greenhouse gas emissions associated with the West Alternative in the planned submission under Condition 28.
29	Greenhouse Gas Offsets	None	Provide a compliance filing pursuant to Condition 29 in in accordance with the timing outlined in the Certificate.	The West Alternative will be incorporated into Trans Mountain's Greenhouse Gas Offset plan that will be submitted under Condition 29.
32	Emergency Response Plans (ERPs)	None	Provide a compliance filing pursuant to Condition 32 in accordance with the timing outlined in the Certificate.	Any effects of the West Alternative on Trans Mountain's Pipeline ERP will be incorporated into the ERP prior to its submission to the BC EAO.
33	Geographic Response Plans (GRPs)	None	Provide a compliance filing pursuant to Condition 33 in accordance with the timing outlined in the Certificate.	Any effect of the West Alternative on Trans Mountain's GRPs will be incorporated into the GRPs prior to their submission to the BC EAO.